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Vol. 156, No. 5 August 2, 1945

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The IRON AGE
July 31, 1945

NEWS FRONT

► Reports from Germany of the interest taken by American experts in German fuel injection systems indicate a revival of the system in this country. Though throughout the war our aircraft has been fueled by carburetion, the Germans have held out steadily for fuel injection.

It is highly probable that some system of fuel injection is already powering our attack on Japan, and American engineers are investigating further uses.

This development parallels the use of a cooling fan on our air-cooled aircraft engines, following the pioneering of such a fan on the only German air-cooled engine produced for aircraft during the war.

► Although the Hughes flying boat is scheduled to be in the air by the end of the year, the company itself considers wood construction inferior to metal, and does not look for wood to have much of a role in future aircraft construction.

► Indications now are that CMP will definitely last until Dec. 31. A main consideration in such retention is the protection of small quantity steel consumers who might be squeezed out in the grab for a marginal supply late this year.

► The Ford plant at Antwerp, which assembled 35,000 vehicles for the European campaign, is scheduled to start soon processing 400 a day for redeployment into the Pacific.

► Western manufacturers are becoming concerned over the volume of the provincial tub-thumping being done in their name in Washington and elsewhere. General feeling on the West Coast is that cheap steel, whoever produces it, is all that is wanted.

Fear of "monopoly" seems also to be stemming from Washington, as westerners seem to be willing enough to welcome any company to operate the steel and aluminum mills, as long as they bring a reasonable hope of steady jobs.

► The newest of the Kaiser-Frazer twins, bearing the latter name, is in a nebulous stage. Scheduled for production in the Graham plant in Detroit, it may resemble the Kaiser car in bearing a Continental engine, with possibly two more cylinders added, and turn up 100 plus hp.

► A new method of railroad car refrigeration shows great promise and will soon be experimentally tested. Devised by Railway Refrigeration Corp., New York, the equipment consists of two steel tanks, a cooling coil, and an expansion valve. There are no mechanically moving parts. Ammonia under pressure in one tank expands through the coils and is absorbed by the water in the other tank.

One charging of the ammonia tank will last for a cross-country trip, and the ammonia-water mixture is processed for ammonia recovery. The simplicity of the process and the extensive plans for servicing augur well for the process, as against a silica-gel method of some years ago which was never able to supplant the conventional use of ice.

► Figures prepared in England show that in the prewar period the British steel industry had an ingot cost index varying (by plants) between 70 and 100; German plants ranged between 84 and 86; French and Belgium plants were 89; United States plants varied from 80 to 95; and India had a figure of 70.

► Annual expenditures of $57,000,000 for research is predicted for about 150 colleges and universities in the U. S. which have organized programs in the natural sciences and engineering. These same programs accounted for $26,000,000 in 1939-40. The higher figure for the postwar period is based somewhat on desire, as in many instances funds are not yet available.

► Only OPA, WPB and the Office of Contract Settlement got any praise among the war agencies in the new Mead Committee report. Waste of manpower by the Army, depletion of iron ore and petroleum reserves and dilatory disposal of war surpluses draw a sharp fire of criticism.

► Pressure for a centralized inventory of surplus machine tools has now expanded to a full fledged Senate committee hearing on the problem of such an inventory for all surplus war goods.

Initial testimony indicates that pressure will be strong enough to overcome the obstacles of high administrative costs, manpower, and space.

Operation of 4-Ton Openhearth

. . . Construction and operating characteristics of J & L's experimental 4-ton openhearth furnace, which has produced over 2100 tons of plain, medium, and high-carbon steels, free-cutting steels, and high-alloy-containing steels. Successive modifications of the original design are traced, and the reasons for the various alterations presented. The value of such a furnace as a research and development tool is discussed. Reproduced by courtesy of the AIME.

By H. K. WORK
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Research and Development Division,
and
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o o o

THE experimental openhearth furnace discussed in this paper was installed in 1938 by the Jones & Laughlin Steel Corp. in its research and development laboratory at Pittsburgh. This furnace was described in a paper entitled "An Experimental Openhearth"* presented in 1939 before the 22nd Openhearth Conference of the American Institute of Mining and Metallurgical Engineers. In that paper was shown in detail the construction of the furnace and no attempt was made to discuss its operation, since, at that time, relatively few heats had been made.

Since May 1938, over 600 heats ranging in weight from 1000 lb to 8900 lb, representing 2100 tons of steel, have been produced, each with a special composition, as part of a particular investigation. Several important developments were made in this furnace, thereby indicating its value for research and development work. In fact it can be said that the value and performance of the experimental furnace exceeded all expectations.

The experimental furnace is quite different in many respects from a conventional openhearth unit. It is a continuous, one-way fired furnace employing a recuperator rather than a regenerative system for preheating the air and is equipped with an all basic roof. This furnace is illustrated in fig. 1. To the right are located the three burners which fire continuously, then the hearth itself, slag pocket and flue and the recuperator. The broken lines represent the original contour of the furnace and indicate the extent to which the furnace design has been altered.

Furnace Lines: Originally a square hearth was employed, with a slag line of 4 ft 6 in. on a side and with a dish-shaped bottom, having a bath depth of 12 in. This hearth permitted 1500 lb of metal to be charged, thereby producing a teemed ingot of 1000 lb, which was considered about the lower limit of ingot weight for making rimming steel. However, this did not prove entirely satisfactory. Due to the relatively great area of ladle refractories and larger radiating surface of the small ladles employed in relation to the volume of metal in the heats, they cool so rapidly during the tapping period as to result in frequent stopper freeze-ups and ladle skulls. Furthermore the ingots produced, due to the more rapid cooling, were not entirely representative of mill production. Therefore it became desirable to enlarge the hearth to accommodate larger heats. This was accomplished by dishing out the bottom and banks. At present the hearth measures 5 ft 8 in. on a side and is 20 in. deep and has a capacity for handling up to 8900 lb of metal. A heat of this size will produce an 8000-lb ingot and represents the limit of the present equipment.

Method of Firing: Three special gas burners are located at one end of the furnace. The burners were designed so as to give a short flame suitable for a furnace of this size. They consist of a 7-in. diameter air chamber and a 1¼-in. gas pipe. The position of the gas pipe may be adjusted axially within the air chamber so that proper combustion may be obtained. The fuel used for firing this furnace to date has been natural gas.

Recuperators: The recuperator itself as has been shown in fig. 1, is of the Fitch type. It consists of two horizontal banks of 18 carborundum tubes each, equipped with corebusters. The tubes are 6-in. outside diameter with a 1-in. wall thickness and are 4 ft 4 in. long. The entire recuperator structure is elevated on a solid concrete base to raise the lowest row of tubes several inches above the top of the slag pocket. This is to avoid attack by iron oxide carried out of the hearth by the waste gases. The exhaust gases flow upward around the outside of the tubes and escape through an 18-in. stack. Air is drawn into the front end of the upper bank of tubes in the opposite direction, by a 5-hp variable speed motor driven fan. This air, which in normal operation is heated to a temperature of approximately 1100°F, is conducted, through a well insulated pipe 12½-in. inside diameter, to a cross main above the three burners. The burners are connected to this pipe by separate 7-in. inside diameter pipes, equipped with manually operated valves.

During the operation of the furnace, a few minor changes were necessary in the recuperator. In 1939, after 167 heats had been made, two of the carborundum tubes in the lower section were replaced and two others were blocked off. At the same time, the

* THE IRON AGE, *May* 4, 1939, *p.* 58. *"An Experimental Openhearth Furnace," by H. K. Work and H. M. Banta, 22nd Openhearth Proceedings, AIME,* 1939, *pp.* 161-174.

concrete base of the recuperator was cut out to extend the slag pocket under the tubes. During the next furnace shutdown, the bottom row of three carborundum tubes, was removed entirely from the lower section. It was found that these three tubes were constantly being attacked by the iron oxide and slag carried over from the hearth.

In 1940, new recuperator blocks were laid in the bottom section to accommodate 15 tubes and the old blocks were employed for the 18 tubes in the top section. A carrying arch was built between the two sections so that the lower section could be replaced without disturbing the upper section. A brick baffle was then constructed in the slag pocket in order to reduce further the cutting action of the flue gases and suspended oxides on the lower rows of tubes. Replacements of tubes, wall brick and baffles were made at various times, but the recuperator remains essentially the same as it was originally, except for the elimination of the bottom row of three tubes.

In 1940 a pump was installed to raise the gas pressure and volume. Increasing the capacity of the furnace made this pump desirable since it allowed a greater flow of gas to the furnace. To provide additional air from the recuperator for proper combustion of this increased gas volume, the blower had to be speeded up considerably. In this connection, if the furnace were being redesigned, it probably would be desirable to have the bottom three recuperator tubes restored, as originally intended, but the lower section should be raised sufficiently to escape the cutting action of the flue gases. This would allow additional passage of preheated air through the lower section of the recuperators, thereby decreasing the load on the blower.

Refractories: Originally the laboratory openhearth had a conventional silica brick roof with a maximum arch of 4 ft 5 in. During the first year of operation, 227 heats were made under this silica roof. These heats were made progressively larger from approximately 1200 lb to a maximum of 3000 lb. As the heats were made larger, it became more difficult to maintain proper operating temperatures, which resulted in an increased number of furnace and ladle skulls. Hence it was decided that temperatures up to 3100°F were necessary. Since temperatures exceeding 3000°F are above the safe working limit for silica refractories, it was decided to replace the silica brick roof with a basic roof of chrome-magnesite brick. In doing this it seemed advisable to raise the roof arch to a 6 ft 9-in. span in order to make a more stable arch since chrome-magnesite brick has a lower load carrying ability and is approximately 60 pct heavier than silica brick.

Seventy-two heats, ending with heat 299, were made under this basic roof. A considerable improvement was noted in the working of the heats, with the furnace temperature often reaching 3200°F. Unfortunately, the chrome-magnesite brick spalled appreciably and affected the slag composition. The chromium, upon being reduced, entered the metallic bath. Thus, some of these heats contained an excessive amount of chromium. Much of this spalling difficulty was no doubt due to temperature fluctuations caused by the intermittent operation of the furnace. To minimize the reduction of chromium from the basic brick, the chrome-magnesite roof was replaced with an improved Metalkase magnesite roof low in chromium content. As a further precaution against spalling, the brick were covered 1-in. thick, with a burnt mica insulating cement. This roof performed very satisfactorily standing, without injury, temperatures 150°F or more above the safe limit for silica brick. After 52 heats were made, the roof appeared rather thin. The mica insulation was removed and 1 in. of fire clay "splits" were laid over the roof. This repair with several additional patches to the insulating cover lasted for an additional 122 heats after which the roof was completely rebuilt with Metalkase magnesite brick. Starting with heat 474, this roof, minus insulation, lasted for 130 heats. Again the roof was replaced with Metalkase magnesite brick and at the time of writing this paper, 42 heats have been produced.

Basic roofs have been in service for five years on the furnace and 415 heats were made under this type roof. This afforded an excellent opportunity to study the characteristics and behavior of these refractories under the most adverse conditions. The experimental furnace operates intermittently and the temperature fluctuates between 2100°F and 3200°F during the working of a single heat. In view of these severe conditions, the behavior of the basic roof is considered very good.

Not too much significance should be attached to the exact number of heats produced under each basic roof since the prime consideration of the laboratory furnace is to produce experimental steels of representative quality. As is true with all small production units, to do this high temperatures and furnace control are of fundamental importance. Without them, as was the case with the silica roof, manipulation and adjustments of furnace practices are so narrowed that the melter is seriously handicapped. Therefore, during roof rebuilds, frequently a patch would have been sufficient for practical operations, but to assure the above conditions, the entire roof structure was replaced.

The principal advantage of the basic roof is that higher temperatures are permissible. This reduces the furnace time and fuel consumption required to melt down and work the heats. The disadvantages of the basic

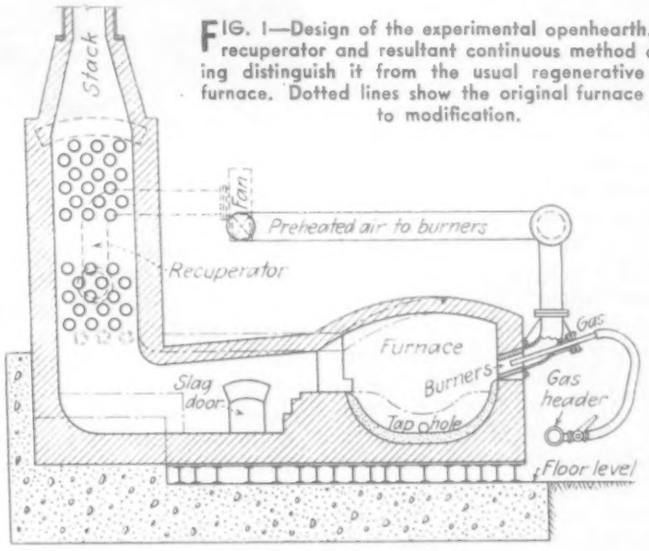


FIG. 1—Design of the experimental openhearth. The recuperator and resultant continuous method of firing distinguish it from the usual regenerative type furnace. Dotted lines show the original furnace prior to modification.

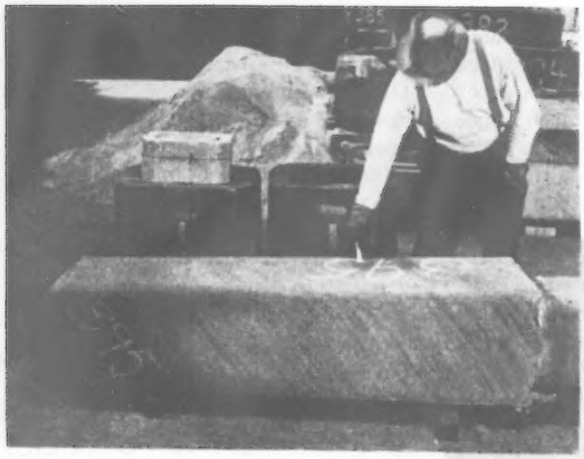


FIG. 2—Killed slab and billet ingots of the size shown here are now being poured in the laboratory shop. Rimming ingots of this size are also produced. These ingots are sufficiently large to be rolled on the blooming mill and subsequently handled in any of the finishing departments.

brick are its greater weight, increased brick cost, lack of load strength and its tendency to spall. In the laboratory furnace, the roof span is small and the structural members are strong enough to support the weight. Since a basic roof is heavier than a silica roof, a sprung arch roof seems impractical for the regular openhearth with its large roof span and light structural members. However, it appears possible that such a roof properly designed, might be justified on a large furnace because of the greater life, better furnace control, and quality advantages.

Instrumentation: The furnace is controlled with the aid of indicating and recording instruments which provide such information as roof temperature, preheated air temperature, air and gas blow and pressures, air-fuel ratio, furnace and stack pressure and waste gas control. The CO_2 recorder serves a dual purpose: it gives an indication of the combustible gases escaping up the stack and also acts as a detector of waste gases entering the preheated air line to the burners. In this way, the operator is informed of damaged tubes in the recuperator and is able to seal them before they can seriously affect the steelmaking.

Carbanalyzer: The relatively rapid drop of carbon in this furnace made necessary some method for controlling

also submitted to the mill for trial. The results of these tests showed that the carbanalyzer filled a need of the industry. The instrument was then placed on the market by the Fisher Scientific Co. and as of today more than 265 carbanalyzers are in current use in the steel industry. This is an interesting by-product of the work on the laboratory furnace.

Auxiliary Equipment: The steel is cast into mill-sized ingots for shaping and rolling by the regular steel mill equipment. For this reason, the usual practice is to melt a heat of 7000 lb to furnish enough metal for an 18x18-in. ingot for bar or tube investigations, a heat of 7900 lb. for a 12x30-in. ingot for plate and strip investigations, and a heat of 8900 lb

these experimental investigations, it is desirable to have complete information about the raw materials charged. Hence the scrap consists of billets rolled from openhearth or bessemer steels. It is carefully selected and is marked by heat numbers and chemical composition. The pig iron, of different grades, is stored separately according to analysis. Since the practice used in the experimental furnace is to catch the carbon on the way down, it is necessary to proportion the charge in such a way that a suitable carbon content is obtained at melt-down, thereby permitting the proper working of the heat. A survey of heats made in the furnace shows that for the heats blocked at high-carbon, the ratio of pig iron to scrap is about 1.12, and for heats blocked at low-carbon, this ratio is about 0.9.

Fluxes: Slag control, as employed in the experimental furnace, consists

this flux charge, it was found that the "lime boil" was excessive and the time required for the "lime up" was too long.

The flux charge at the present time consists of 6 pct to 8 pct limestone and approximately 1 pct of burnt lime for a total of 7 pct to 9 pct of the metallic charge. The ratio of CaO to SiO_2 in the slag at the end of the lime boil period should be about 2.5. Any deficiency in lime is added as necessary, based on the slag and bath conditions during the working period of the heat, the purpose being to form a high CaO to SiO_2 ratio slag during the final stages of the heat.

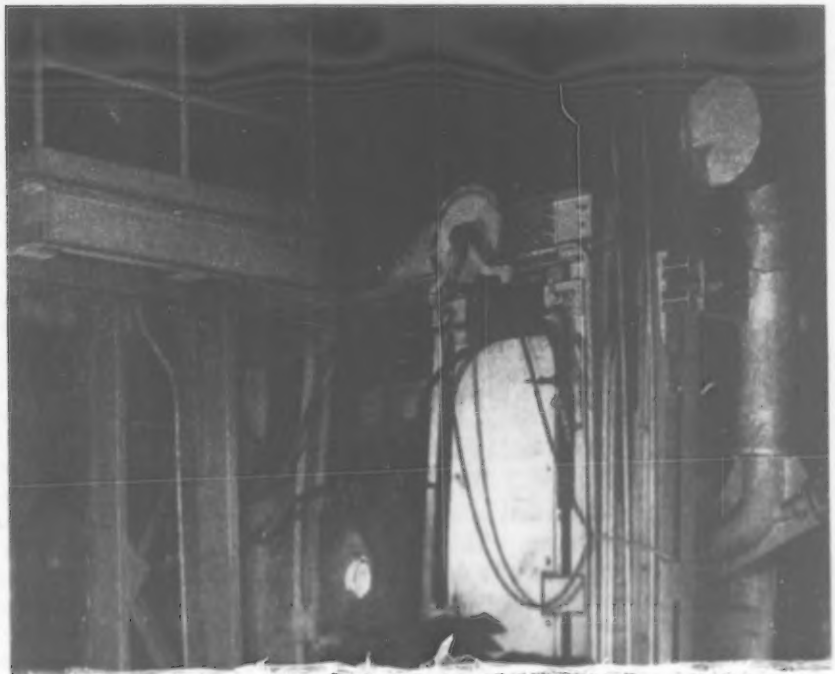
When steel of fairly low phosphorus content is desired, an amount of Staflux, equivalent to about 0.75 pct of the metallic charge, is added to raise the FeO content of the slag. This increases the ability of the slag to remove phosphorus. Fifty pounds of roll scale are charged with the Staflux for higher carbon heats. Typical examples of furnace charges for various grades of steel are given in table I and fig. 3 shows the furnace materials for one of these steels ready to be charged.

TABLE I
Typical Charges for Carbon Steels

Heat No.	C at Block, Pct	Charge, in Lb				
		Pig Iron	Scrap	Limestone	Staflux	Roll Scale
1	0.55	3700	3300	400	50	50
2	0.17	3500	3500	400	50	...
3	0.10	3400	3600	400	50	...
4	0.06	3300	3700	400	...	...

Charging the Furnace: The present charging practice employed for the experimental furnace is the result of considerable experience and will be briefly described. As previously stated, the furnace is intermittently operated and to avoid an exceptionally long melt-down period due to a cold hearth, the furnace temperature is gradually raised to about 3050°F before the charging operation is started. The furnace is drained and then flushed wih an air hose. This chills the exposed surface of the hearth and helps prevent the heat from melting soft. The tap hole is then sealed and the initial charge of stone and scrap is made. These additions are at the stage of incipient fusion before the pig iron addition is made. The pig iron is charged level. It has been found that level charging is essential for quick melting, rapid slag formation and reduction of gas oxidation. The total time required to charge the furnace is 1 hr 40 min. Charging is undoubtedly the most important single item affecting the operation of this furnace since deviations from the above practice almost always result in difficulty later on in the heat.

FIG. 3—A typical furnace charge of scrap, pig iron, limestone and burnt lime is shown ready for manual charging in front of the openhearth.



Melting Period: Upon completion of the iron charge, the final melt-down period begins. Throughout this period the flow of gas and air are kept at a maximum of 4900 and 54,000 cu ft per hr respectively under a positive furnace pressure of approximately 0.09 in. of water. The FeO, formed while the charge is melting by the excess oxygen of the burned gases oxidizing the scrap, is dissolved gradually and in turn oxidizes the silicon and the major part of the manganese in the bath. Some of the silica formed combines with the lime and some with the oxides of manganese and iron. If the basic elements are insufficient to

3 in. to 12 in. $52.00
12 in. to 16 in. 64.00

drop of carbon in this furnace made necessary some method for controlling

investigations, and a heat of 8900 lb

Fluxes: Slag control, as employed in the experimental furnace, consists

Cold rolled [1]	3.05¢	3.05¢	3.05¢	3.05¢		3.05¢	3.05¢		3.15¢	3.05¢		3.70¢	3.15¢	3.39¢	3.37¢
Galvanized (24 gage)[7]	3.70¢	3.70¢	3.70¢		3.70¢	3.70¢	3.70¢	3.70¢	3.80¢	3.70¢		4.25¢		3.94¢	3.87¢
Enameling (20 gage)	3.45¢	3.45¢	3.45¢	3.45¢			3.45¢		3.55¢	3.45¢		4.10¢	3.55¢	3.81¢	3.77¢
Long ternes [2]	3.80¢	3.80¢	3.80¢									4.55¢		4.16¢	4.12¢
STRIP															
Hot rolled [3]	2.10¢	2.10¢	2.10¢	2.10¢	2.10¢		2.10¢			2.10¢		2.75¢	2.20¢	2.46¢	
Cold rolled [4]	2.80¢	2.90¢		2.80¢			2.80¢	(Worcester=3.00¢)					2.90¢	3.16¢	
Cooperage stock	2.20¢	2.20¢			2.20¢		2.20¢							2.56¢	
Commodity C-R	2.95¢	2.95¢		2.95¢			2.95¢	(Worcester=3.35¢)					3.05¢	3.31¢	
TIN PLATE															
Standard cokes, base box	$5.00	$5.00	$5.00						$5.10					5.36¢	5.32¢
Electro, box { 0.25 lb.	$4.35	$4.35	$4.35												
0.50 lb.	$4.50	$4.50	$4.50						$4.60						
0.75 lb.	$4.65		$4.65						$4.75						
BLACK PLATE															
29 gage [6]	3.05¢	3.05¢	3.05¢						3.15¢			4.05¢[11]			3.37¢
TERNES, MFG.															
Special coated, base box	$4.30	$4.30	$4.30						$4.40						
BARS															
Carbon steel	2.25¢	2.25¢	2.25¢	2.25¢	2.25¢	2.25¢		(Duluth=2.35¢)			2.60¢	2.90¢	2.35¢	2.59¢	2.57¢
Rail steel[8]	2.25¢	2.25¢	2.25¢	2.25¢	2.25¢	2.25¢					2.60¢	2.90¢			
Reinforcing (billet) [7]	2.15¢	2.15¢	2.15¢	2.15¢	2.15¢	2.15¢	2.15¢	2.15¢			2.50¢	2.55¢	2.25¢	2.39¢	
Reinforcing (rail) [7]	2.15¢	2.15¢	2.15¢	2.15¢	2.15¢	2.15¢	2.15¢				2.50¢	2.55¢	2.25¢		2.47¢
Cold finished [5]	2.65¢	2.65¢	2.65¢	2.65¢		2.65¢		(Detroit=2.70¢)			(Toledo=2.80¢)			2.99¢	2.97¢
Alloy, hot rolled	2.70¢	2.70¢				2.70¢		(Bethlehem, Massillon, Canton=2.70¢)					2.80¢		
Alloy, cold drawn	3.35¢	3.35¢	3.35¢	3.35¢		3.35¢							3.45¢		
PLATES								(Coatesville and Claymont=2.25¢)							
Carbon steel [13]	2.25¢	2.25¢	2.25¢	2.25¢	2.25¢		2.25¢	2.25¢			2.60¢	2.80¢	2.47¢	2.44¢	2.30¢
Floor plates	3.50¢	3.50¢									3.85¢	4.15¢		3.86¢	3.82¢
Alloy	3.50¢	3.50¢			(Coatesville=3.50¢)						3.95¢	4.15¢		3.70¢	3.59¢
SHAPES															
Structural	2.10¢	2.10¢	2.10¢		2.10¢	2.10¢	(Bethlehem=2.10¢)				2.45¢	2.75¢		2.27¢	2.215¢
SPRING STEEL, C-R															
0.26 to 0.50 Carbon	2.80¢			2.80¢			(Worcester=3.00¢)								
0.51 to 0.75 Carbon	4.30¢			4.30¢			(Worcester=4.50¢)								
0.76 to 1.00 Carbon	6.15¢			6.15¢			(Worcester=6.35¢)								
1.01 to 1.25 Carbon	8.35¢			8.35¢			(Worcester=8.55¢)								
WIRE [9]															
Bright [12]	2.75¢	2.75¢		2.75¢	2.75¢		(Worcester=2.85¢)		(Duluth=2.80¢)			3.25¢			3.07¢
Galvanized [9]	Add proper size extra and galvanizing extra to Bright Wire base														
Spring (High Carbon)	3.35¢	3.35¢		3.35¢			(Worcester=3.45¢)					3.85¢			3.67¢
PILING															
Steel Sheet	2.40¢	2.40¢				2.40¢						2.95¢			2.72¢

SEMI-FINISHED STEEL

Ingots, Carbon, Rerolling

Base per gross ton, f.o.b. mill.... $31.00

Ingots, Carbon, Forging

Base per gross ton, f.o.b. Birmingham, Buffalo, Chicago, Cleveland, Gary, Pittsburgh, Youngstown $36.00

Ingots, Alloy

Base per gross ton, f.o.b. Bethlehem, Buffalo, Canton, Coatesville, Chicago, Massillon, Pittsburgh $45.00

Billets, Blooms and Slabs

Pittsburgh, Chicago, Gary, Cleveland, Youngstown, Buffalo, Birmingham, Sparrows Point (rerolling only). Prices delivered Detroit are $2.00 higher; delivered E. Michigan, $3 higher; f.o.b. Duluth, billets only, $2.00 higher; billets f.o.b. Pacific ports are $12 higher. Provo, $11.20 higher. Delivered prices do not reflect three per cent tax on freight rates.

Per Gross Ton

Rerolling $36.00
Forging quality 42.00

Alloy Billets, Blooms, Slabs

Pittsburgh, Chicago, Canton, Massillon, Buffalo or Bethlehem. per gross ton $54.00

Price delivered Detroit $2.00 higher; East Michigan, $3.90 higher.

Sheet Bars

Pittsburgh, Chicago, Cleveland, Youngstown, Buffalo, Canton, Sparrows Point.

Per Gross Ton

Open hearth or bessemer $36.00

3 in. to 12 in.	$52.00
12 in. to 18 in.	54.00
18 in. and over	56.00

Basic open hearth shell steel, f.o.b. Pittsburgh, Chicago, Buffalo, Gary, Cleveland, Youngstown and Birmingham.

Prices delivered Detroit are $2.00 higher; East Michigan, $3 higher.

Price Exceptions: Follansbee Steel Corp. permitted to sell at $13.00 per gross ton, f.o.b. Toronto, Ohio, above base price of $52.00.

Note: The above base prices apply on lots of 1000 tons of a size and section to which are to be added extras for chemical requirements, cutting, or quantity.

RAILS, TRACK SUPPLIES

(F.o.b. Mill)

Standard rails, heavier than 60 lb., No. 1 O.H., gross ton	$43.00
Angle splice bars, 100 lb.	2.70
(F.o.b. Basing Points)	*Per Gross Ton*
Light rails (from billets)	$45.00
Light rails (from rail steel)	44.00
	Base per Lb.
Cut spikes	3.25c.
Screw spikes	5.40c.
Tie plate, steel	2.30c.
Tie plates, Pacific Coast	2.45c.
Track bolts	4.75c.
Track bolts, heat treated, to railroads	5.00c.
Track bolts, jobbers discount	62-5

Basing points, light rails, Pittsburgh, Chicago, Birmingham; cut spikes and tie plates—Pittsburgh, Chicago, Portsmouth, Ohio, Weirton, W. Va., St. Louis, Kansas City, Minnequa, Colo., Birmingham and Pacific Coast ports; tie plates alone—Steelton, Pa., Buffalo. Cut spikes alone—Youngstown, Lebanon, Pa., Richmond, Oregon and Washington ports, add 25c.

TOOL STEEL

(F.o.b. Pittsburgh, Bethlehem, Syracuse)

	Base per lb.
High speed	67c.
Straight molybdenum	54c.
Tungsten-molybdenum	57½c.
High-carbon-chromium	43c.
Oil hardening	24c.
Special carbon	22c.
Extra carbon	18c.
Regular carbon	14c.

Warehouse prices east of Mississippi are 2c. a lb. higher; west of Mississippi 3c. higher.

WIRE PRODUCTS

To the trade, f.o.b. Pittsburgh, Chicago, Cleveland, Birmingham, Duluth

	Basing Points Named	*Pacific Coast Basing Points†*
	Base per Keg	
Standard wire nails	$2.90	$3.40
Coated nails	2.90	3.40
Cut nails, carloads	3.85	....
	Base per 100 Lb.	
Annealed fence wire	$3.05	$3.55
Annealed galv. fence wire	3.40	3.90
	Base Column	
Woven wire fence*	67	85
Fence posts, carloads	69	86
Single loop bale ties	66	91
Galvanized barbed wire**	72	82
Twisted barbless wire	72	....

*15½ gage and heavier. **On 80-rod spools in carload quantities.

†Prices subject to switching or transportation charges.

The family washline is not really complete without the clothes of at least three people. And no line of *metal cleaners* is what it should be unless it has products for all jobs —heavy or light, big or little.

That's why Wyandotte Metal Cleaners give such satisfaction. There's one of these *specialized* products to meet almost any metal cleaning need — for cleaning after machining and prior to plating, painting, lacquering, blackening, anodizing or spot welding.

For help on any metal-cleaning problem, call on the Wyandotte Field Engineer. He'll be glad to show you how Wyandotte Metal Cleaners can save you time, labor and money. And you'll find him ready with advice about that future expansion you're planning.

Wyandotte

REG. U. S. PAT. OFF.

WYANDOTTE CHEMICALS CORPORATION • *J. B. Ford Division*

WYANDOTTE, MICHIGAN • *Service Representatives in 88 Cities*

WAREHOUSE PRICES

Delivered metropolitan areas per 100 lb. These are zoned warehouse prices in conformance with latest zoning amendment to OPA Price Schedule 49.

Cities	SHEETS			STRIP		Plates ¼ in. and heavier	Structural Shapes	BARS		ALLOY BARS			
	Hot Rolled (10 gage)	Cold Rolled	Galvanized (24 gage)	Hot Rolled	Cold Rolled			Hot Rolled	Cold Finished	Hot Rolled, NE 8617-20	Hot Rolled, NE 9442-45 Ann.	Cold Drawn, NE 8617-20	Cold Drawn, NE 9442-45 Ann.
**Philadelphia	$3.518	$4.872[6]	$4.768a	$3.922	$4.772	$3.805	$3.668	$3.822	$4.072	$5.818	$6.868	$7.072	$8.172
New York	3.59	4.613[3]	5.110	3.974[6]	4.772	3.768	3.758	3.853	4.103	5.858	6.908	7.103	8.203
Boston	3.744	4.744[9]	5.224[9]	4.106	4.715	3.912	3.912	4.044	4.144	6.012	7.062	7.194	8.394
Baltimore	3.394	4.852	4.894	3.902	4.752	3.594	3.759	3.802	4.052	....	....	....	....
Norfolk	3.771	4.965	5.371	4.165	4.865	3.971	4.002	4.065	4.165	....	....	....	....
Chicago	3.25	4.20	5.231	3.60	4.85[17]	3.55	3.55	3.50	3.75	5.60	6.65	6.65	7.90
Milwaukee	3.387	4.337[3]	5.272[4]	3.737	4.787[17]	3.687	3.687	3.637	3.887	5.837	6.887	6.887	7.987
Cleveland	3.35	4.40	4.877[4]	3.60	4.45	3.40	3.588	3.35	3.75	5.806	6.856	6.65	7.75
Buffalo	3.35	4.40	4.75[4]	3.819	4.669	3.63	3.40	3.35	3.75	5.60	6.65	6.65	7.75
Detroit	3.45	4.50	5.00[4]	3.70	4.859[17]	3.609	3.661	3.45	3.80	5.93	6.98	6.959	8.059
Cincinnati	3.425	4.475[3]	4.825[5]	3.675	4.711	3.661	3.691	3.611	4.011	5.95	7.00	7.011	8.261
St. Louis	3.397	4.347[3]	5.172[4]	3.747	4.931[17]	3.697	3.697	3.647	4.031	5.981	7.031	7.031	8.131
Pittsburgh	3.35	4.40	4.75	3.60	4.45	3.40	3.40	3.35	3.75	5.60	6.65	6.65	7.90
St. Paul	3.50	4.46	5.257[4]	3.86	5.102[17]	3.513	3.513	3.763	4.361	5.94	6.99	7.361	8.461
Omaha	3.865	5.443	5.608[4]	4.215	....	4.165	4.165	4.115	4.443	....	....	....	....
Indianapolis	3.518	4.568	4.548	3.768	4.741	3.63	3.63	3.58	3.98	5.93	6.98	6.98	8.23
Birmingham	3.45	....	4.75	3.70	....	3.55	3.55	3.50	4.43	....	....	....	....
Memphis	3.965[7]	4.66	5.265	4.215	....	4.065	4.065	4.015	4.33	....	....	....	....
New Orleans	4.058*	5.079	5.358	4.308	....	4.158	4.158*	4.108*	4.629	....	....	....	....
Houston	3.763	5.573	6.313[1]	4.313	....	4.25	4.25	3.75	6.373[2]	7.223	8.323	8.323	9.373
Los Angeles	5.00	7.20[3]	6.10[4]	4.95	5.813[15]	4.95	4.65	4.40	5.583	8.204	9.404	9.304	10.454
San Francisco	4.55[14]	7.30[4]	6.35[4]	4.50[14]	7.333[17]	4.65[14]	4.35[14]	4.15[14]	5.333	8.304	9.404	9.404	10.454
Seattle	4.65[12]	7.05[4]	5.95[4]	4.25[12]	....	4.75[12]	4.45[12]	4.35[12]	5.783	....	9.404	....	....
Portland	4.65[11]	8.60[4]	5.75[4]	4.75[11]	....	4.85[11]	4.45[11]	4.45[11]	5.533	8.304	9.404	8.304	9.404
Salt Lake City	4.530[17]	....	6.171[3]	5.53[17]	....	4.98[17]	4.98[17]	4.88[17]	5.90	....	....	....	....

National Emergency Steels

MILL EXTRAS

Designation	Basic Open-Hearth		Electric Furnace		Designation	Basic Open-Hearth		Electric Furnace	
	Bars and Bar-Strip	Billets, Blooms, and Slabs	Bars and Bar-Strip	Billets, Blooms, and Slabs		Bars and Bar-Strip	Billets, Blooms, and Slabs	Bars and Bar-Strip	Billets, Blooms, and Slabs
NE 8612	0.65¢	$13.00	$1.15	$23.00	NE 9427	0.75¢	$15.00	$1.25	$25.00
NE 8615	0.65	13.00	1.15	23.00	NE 9430	0.75	15.00	1.25	25.00
NE 8617	0.65	13.00	1.15	23.00	NE 9432	0.75	15.00	1.25	25.00
NE 8620	0.65	13.00	1.15	23.00	NE 9435	0.75	15.00	1.25	25.00
NE 8622	0.65	13.00	1.15	23.00	NE 9437	0.75	15.00	1.25	25.00
NE 8625	0.65	13.00	1.15	23.00	NE 9440	0.75	15.00	1.25	25.00
NE 8627	0.65	13.00	1.15	23.00	NE 9442	0.80	16.00	1.30	26.00
NE 8630	0.65	13.00	1.15	23.00	NE 9445	0.80	16.00	1.30	26.00
NE 8632	0.65	13.00	1.15	23.00	NE 9447	0.80	16.00	1.30	26.00
NE 8635	0.65	13.00	1.15	23.00	NE 9450	0.80	16.00	1.30	26.00
NE 8637	0.65	13.00	1.15	23.00					
NE 8640	0.65	13.00	1.15	23.00					
NE 8642	0.65	13.00	1.15	23.00	NE 9722	0.65	13.00	1.15	23.00
NE 8645	0.65	13.00	1.15	23.00	NE 9727	0.65	13.00	1.15	23.00
NE 8647	0.65	13.00	1.15	23.00	NE 9732	0.65	13.00	1.15	23.00
NE 8650	0.65	13.00	1.15	23.00	NE 9737	0.65	13.00	1.15	23.00
					NE 9742	0.65	13.00	1.15	23.00
					NE 9745	0.65	13.00	1.15	23.00
NE 8712	0.70	14.00	1.20	24.00	NE 9747	0.65	13.00	1.15	23.00
NE 8715	0.70	14.00	1.20	24.00	NE 9750	0.65	13.00	1.15	23.00
NE 8717	0.70	14.00	1.20	24.00	NE 9763	0.65	13.00	1.15	23.00
NE 8720	0.70	14.00	1.20	24.00	NE 9768	0.65	13.00	1.15	23.00
NE 8722	0.70	14.00	1.20	24.00					
NE 8725	0.70	14.00	1.20	24.00					
NE 8727	0.70	14.00	1.20	24.00	NE 9830	1.30	26.00	1.80	36.00
NE 8730	0.70	14.00	1.20	24.00	NE 9832	1.30	26.00	1.80	36.00
NE 8732	0.70	14.00	1.20	24.00	NE 9836	1.30	26.00	1.80	36.00
NE 8735	0.70	14.00	1.20	24.00	NE 9837	1.30	26.00	1.80	36.00
NE 8737	0.70	14.00	1.20	24.00	NE 9840	1.30	26.00	1.80	36.00
NE 8740	0.70	14.00	1.20	24.00	NE 9842	1.30	26.00	1.80	36.00
NE 8742	0.70	14.00	1.20	24.00	NE 9845	1.30	26.00	1.80	36.00
NE 8745	0.70	14.00	1.20	24.00	NE 9847	1.30	26.00	1.80	36.00
NE 8747	0.70	14.00	1.20	24.00	NE 9850	1.30	26.00	1.80	36.00
NE 8750	0.70	14.00	1.20	24.00					
					*NE 9912	1.20	24.00	1.55	31.00
NE 9415	0.75	15.00	1.25	25.00	NE 9915	1.20	24.00	1.55	31.00
NE 9417	0.75	15.00	1.25	25.00	NE 9917	1.20	24.00	1.55	31.00
NE 9420	0.75	15.00	1.25	25.00	NE 9920	1.20	24.00	1.55	31.00
NE 9422	0.75	15.00	1.25	25.00	NE 9922	1.20	24.00	1.55	31.00
NE 9425	0.75	15.00	1.25	25.00	NE 9925	1.20	24.00	1.65	31.00

Note 1: The ranges shown are restricted to sizes 100 sq. in. or less or equivalent cross-sectional area 18 in. wide or under with a maximum individual piece weight of 7000 lb. irrespective of size. Note 2: For steels ordered to such ranges, below the size and weight restriction, the average of all the chemical checks must be within the limits specified subject to check analysis variations given in Table 4, Section 10, AISI Steel Products Manual. Note 3: When acid open-hearth is specified and acceptable, add to basic open-hearth alloy differential 0.25c. per lb. for bars and bar strip and $5 per gross ton for billets, blooms and slabs. Note 4: The extras shown are in addition to the base price of $2.70 for 100 lb. on finished products and $54 per gross ton on semi-finished steel, major basing points, and are in cents per pound when applicable to bars and bar-strip and in dollars per gross ton when applicable to billets, blooms and slabs. The full extra applicable over the base price is the total of all extras indicated by the specific requirements of the order. The higher extra shall be charged for any size falling between two published extras.

BASE QUANTITIES

Standard unless otherwise keyed on prices.

HOT ROLLED: Sheets, strip, plates, shapes and bars, 400 to 1999 lb.

COLD ROLLED: Sheets, 400 to 1499 lb.; strip, extras on all quantities; bars, 1500 lb. base.

NE ALLOY BARS: 1000 to 39,999 lb.

EXCEPTIONS: (1) 150 to 499 lb. (2) 150 to 1499 lb. (3) 400 to 1499 lb. (4) 450 to 1499 lb. (5) 500 to 1499 lb. (6) 0 to 199 lb. (7) 400 to 1499 lb. (8) 1000 to 1999 lb. (9) 450 to 3749 lb. (10) 400 to 3999 lb. (11) 300 to 4999 lb. (12) 300 to 10,000 lb. (13) 400 to 14,999 lb. (14) 400 lb. and over. (15) 1000 lb. and over. (16) 1500 lb. and over. (17) 2000 lb. and over. (18) 3500 lb. and over.

(a) Philadelphia: Galvanized sheet, 25 or more bundles.

Extra for size, quality, etc., apply on above quotations.

*Add 0.271c. for sizes not rolled in Birmingham.

**City of Philadelphia only. Applicable freight rates must be added to basing point prices to obtain delivered price to other localities in metropolitan area.

LAKE SUPERIOR ORES

(51.50% *Fe, Natural Content, Delivered Lower Ports**)

	Per Gross Ton
Old range, bessemer, 51.50	$4.75
Old range, non-bessemer, 51.50	4.60
Mesaba, bessemer, 51.50	4.60
Mesaba, non-bessemer, 51.50	4.45
High phosphorus, 51.50	4.35

*Adjustments are made to indicate prices based on variance of Fe content of ores as analyzed on a dry basis by independent laboratories.

FLUORSPAR

Maximum price f.o.b. consumer's plant, $30 per short ton plus either (1) rail freight from producer to consumer, or (2) rail freight from Rosiclare, Ill., to consumer, whichever is lower.

Exception

When the WPB Steel Division certifies in writing the consumer's need for one of the higher grades of metallurgical fluorspar specified in the table below the price shall be taken from the table plus items (1 and 2) from paragraph above.

Effective CaF_2 Content:	*Base price per short ton*
70% or more	$33.00
65% but less than 70%	32.00
60% but less than 65%	31.00
Less than 60%	30.00

PRICES

WELDED PIPE AND TUBING

Base discounts, f.o.b. Pittsburgh district and Lorain, Ohio, mills

(F.o.b. Pittsburgh only on wrought pipe) base price—$200.00 per net ton

	Black	Galv.
Steel (buttweld)		
½-in.	63½	51
¾-in.	66½	55
1-in. to 3-in.	68½	57½
Wrought Iron (buttweld)		
½-in.	24	3½
¾-in.	30	10
1-in. and 1¼-in.	34	16
1½-in.	38	18½
2-in.	37½	18
Steel (lapweld)		
2-in.	61	49½
2½-in. and 3-in.	64	52½
3½-in. to 6-in.	66	54½
Wrought Iron (lapweld)		
2-in.	30½	12
2½-in. to 3½-in.	31½	14½
4-in.	33½	18
4½-in. to 8-in.	32½	17
Steel (butt, extra strong, plain ends)		
½-in.	61½	50½
¾-in.	65½	54½
1-in. to 3-in.	67	57
Wrought Iron (same as above)		
½-in.	25	6
¾-in.	31	12
1-in. to 2-in.	38	19½
Steel (lap, extra strong, plain ends)		
2-in.	59	48½
2½-in. and 3-in.	63	52½
3½-in. to 6-in.	66½	56
Wrought Iron (same as above)		
2-in.	33½	15½
2½-in. to 4-in.	39	22½
4½-in. to 6-in.	37½	21

On buttweld and lapweld steel pipe jobbers are granted a discount of 5 pct. On l.c.l. shipments prices are determined by adding 25 pct and 30 pct and the carload freight rate to the base card.

F.o.b. Gary prices are two points lower discount or $4 a ton higher than Pittsburgh or Lorain on lapweld and one point lower discount, or $2 a ton higher on all buttweld.

CAST IRON WATER PIPE

	per net ton
6-in. and larger, del'd Chicago	$54.80
6-in. and larger, del'd New York	52.20
6-in. and larger, Birmingham	46.00
6-in. and larger f.o.b. cars, San Francisco or Los Angeles	69.40
6-in. and larger f.o.b. cars, Seattle	71.20

Class "A" and gas pipe, $3 extra; 4-in. pipe is $3 a ton above 6-in. Prices shown are for lots of less than 200 tons. For 200 tons or over, 6-in. and larger are $45 at Birmingham and $53.80 delivered Chicago, $59.40 at San Francisco and Los Angeles, and $70.20 at Seattle. Delivered prices do not reflect 3 pct tax on freight rates.

BOILER TUBES

Seamless steel and lapweld commercial boiler tubes and locomotive tubes, Minimum wall. Net base prices per 100 ft f.o.b. Pittsburgh, in carload lots.

	Seamless Cold Drawn	*Hot Rolled*	*Lap Weld, Hot Rolled*
2 in. O.D. 13 B.W.G.	15.03	13.04	12.38
2½ in. O.D. 12 B.W.G.	20.21	17.54	16.58
3 in. O.D. 12 B.W.G.	22.48	19.50	18.35
3½ in. O.D. 11 B.W.G.	28.37	24.62	23.15
4 in. O.D. 10 B.W.G.	35.20	30.54	28.66

(Extras for less carload quantities)

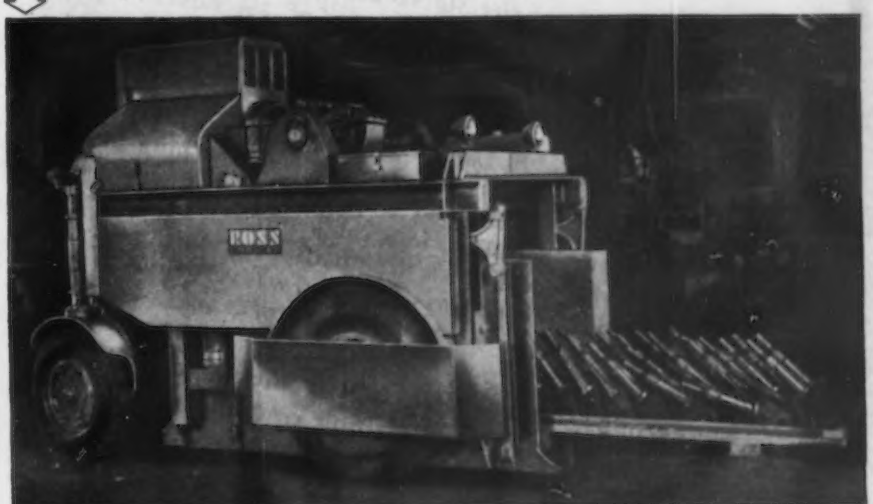
40,000 lb or ft and over	Base
30,000 lb or ft to 39,999 lb or ft	5 pct
20,000 lb or ft to 29,999 lb or ft	10 pct
10,000 lb or ft to 19,999 lb or ft	20 pct
5,000 lb or ft to 9,999 lb or ft	30 pct
2,000 lb or ft or 4,999 lb or ft	45 pct
Under 2,000 lb or ft	65 pct

ROSS SERIES 70 STRADDLE CARRIER

Operates Where No Other Carrier Can!

FASTER LOWER COST MATERIALS-HANDLING

Series 70 Straddle Carrier offers an economical solution to the ever-present problem of handling materials with maximum speed, at rock-bottom cost. Handles heavy, palletized loads with utmost efficiency over rough ground, through mud or snow. Maneuvers easily in crowded quarters . . . Get the details about how Ross Series 70 Straddle Carrier can reduce *your* materials-handling costs. Write today—ask for Bulletin IA-75.



THE ROSS CARRIER COMPANY • Benton Harbor, Michigan

Direct Factory Branches and Distributors Throughout The United States and Canada

ROSS

HEAVY DUTY MATERIALS-HANDLING EQUIPMENT

BENTON HARBOR • MICHIGAN

Actual Tests Prove

LIONITE

LASTS LONGER DOES A BETTER JOB

● It has been repeatedly demonstrated that LIONITE Abrasive Grains last longer on polishing wheels and do a better job of polishing. The results below were achieved in users' plants by their own operators.

JOB 1 Polishing wheels of size 46 CBT Lionite with glue, polished 90 to 130 discs and corn planter runners per wheel, as compared with 40 to 60 pieces per wheel with grain previously used.

JOB 2 Wheels of size 36 NB Lionite, setup with cement, lasted an average of 2½ hours each, polishing hammers, where another make of grain lasted only 1¼ hours.

JOB 3 Size 46 NB Lionite, recommended by Lionite engineers for cleaning and polishing castings, increased production many times over and all castings came through clean with good finish. Competitor's grain previously used was size 70 and was very slow, wheels loaded and work burned.

Perhaps some similar improvement can be made in your polishing operation. Ask to have a Lionite engineer call.

GENERAL ABRASIVE COMPANY, INC.

Lionite and Carbonite Abrasive Grains

NIAGARA FALLS, NEW YORK, U. S. A.

CORROSION AND HEAT-RESISTING STEEL

(Per lb. base price, f.o.b. Pittsburgh)

Chromium-Nickel Alloys

	No. 304	No. 302
Forging billets	21.25c.	20.40c.
Bars	25.00c.	24.00c.
Plates	29.00c.	27.00c.
Structural shapes	25.00c.	24.00c.
Sheets	36.00c.	34.00c.
Hot rolled strip	23.50c.	21.50c.
Cold rolled strip	30.00c.	28.00c.
Drawn wire	25.00c.	24.00c.

Straight-Chromium Alloys

	No. 410	No. 430	No. 442	No. 446
F.Billets	15.725c.	16.15c.	19.125c.	23.375c.
Bars	18.50c.	19.00c.	22.50c.	27.50c.
Plates	21.50c.	22.00c.	25.50c.	30.50c.
Sheets	26.50c.	29.00c.	32.50c.	36.50c.
Hot strip	17.00c.	17.50c.	24.00c.	35.00c.
Cold strip	22.00c.	22.50c.	32.00c.	52.00c.

Chromium-Nickel Clad Steel (20%)

	No. 304
Plates	18.00c.*
Sheets	19.00c.

*Includes annealing and pickling.

REFRACTORIES

(F.o.b. Works)

Fire Clay Brick

	Per 1000
Super-duty brick, St. Louis	$68.55
First quality, Pa., Md., Ky., Mo., Ill.	54.45
First quality, New Jersey	59.45
Sec. quality, Pa., Md. Ky., Mo., Ill.	49.40
Sec. quality, New Jersey	54.15
No. 1 Ohio	45.75
Ground fire clay, net ton	8.05

Silica Brick

Pennsylvania and Birmingham	$54.45
Chicago District	62.45
Silica cement, net ton (Eastern)	9.55

Chrome Brick

	Per Net Ton
Standard chemically bonded, Balt., Plymouth Meeting, Chester	$54.00

Magnesite Brick

Standard, Balt. and Chester	$76.00
Chemically bonded, Baltimore	65.00

Grain Magnesite

Domestic, f.o.b. Balt. and Chester in sacks (carloads)	$43.48
Domestic, f.o.b. Chewelah, Wash. (in bulk)	22.00

EXCEPTIONS TO RPS 6

Ingots, carbon, rerolling—Phoenix Iron Co. may charge $38.75; Kaiser Co., $43.00 f.o.b. Pacific Coast ports; Empire Sheet & Tinplate Co., $34.25; Pgh. Steel Co., $33.10. Granite City Steel, $39.45.

Ingots, carbon, forging—Phoenix Iron Co. may charge $43.00; Empire Sheet & Tinplate Co., $39.25, f.o.b. Mansfield, Ohio; West Coast producers, $48.00, f.o.b. Pacific Coast Ports; Pgh. Steel Co., $38.10.

Ingots, alloy—C/1 delivered Detroit add $2.00; delivered East Michigan add $3.00. Connors Steel Co. may charge $45.00 f.o.b. Birmingham.

Slabs, per gross ton—Andrews Steel Co. $41 basing pts.; Wheeling Steel Corp. (rerolling) 4 in. sq. or larger $37.75 f.o.b. Portsmouth, Ohio; Empire Sheet & Tin Plate Corp. $41; Phoenix Iron Co. (rerolling) $41, (forging) $47; Granite City Steel $47.50; Kaiser Co., (rerolling) $58.64, (forging) $64.64, f.o.b. Los Angeles.

Blooms, per gross ton—Phoenix Iron Co. (rerolling) $41; (forging) $47; Pgh. Steel Co. (rerolling) $38.25, (forging) $44.25; Wheeling Steel Corp. (rerolling) 4 in. sq. or larger $37.75 f.o.b. Portsmouth; Kaiser Co. (rerolling) $58.64, (forging) $64.64 (shell steel) $74.64 f.o.b. Los Angeles.

Sheet Bar, per gross ton—Empire Sheet & Tinplate Co. $39 mill; Wheeling Steel Corp. $38 Portsmouth, Ohio.

Billets, Forging, per gross ton—Andrews Steel Co. $50 basing pts.; Follansbee Steel Corp. $49.50 Toronto, Ohio; Phoenix Iron Co. $47 mill; Geneva Steel Co. $64.64 f.o.b. Pacific Coast; Pittsburgh Steel Co. $49.50; Kaiser Co. $64.64, (shell steel) $74.64, f.o.b. Los Angeles.

PRICES

Billets, Rerolling, per gross ton—Continental Steel Corp. may charge Acme Steel in Chicago switching area $34 plus freight from Kokomo, Ind.; Northwestern Steel & Wire Co. (Lend-Lease) $41 mill; Wheeling Steel Corp. 4 in. sq. or larger $37.75, smaller $39.50 f.o.b. Portsmouth, Ohio; Stanley Works may sell Washburn Wire Co. under allocation at $39 Bridgeport, Conn.; Keystone Steel & Wire Co. may sell Acme Steel Co. at Chicago base, f.o.b. Peoria; Phoenix Iron Co. $41 mill; Continental Steel Corp. (1¾ x 1¾) $39.50, (2 x 2) $40.60 Kokomo, Ind. (these prices include $1 size extra); Keystone Steel & Wire Co. $36.40 Peoria; Connors Steel Co. $50.60 Birmingham; Ford Motor Co. $34 Dearborn, Mich.; Geneva Steel Co. $58.64 f.o.b. Pacific Coast; Pgh. Steel Co. $43.50; Kaiser Co. $58.64 f.o.b. Los Angeles.

Structural Shapes—Phoenix Iron Co. 2.35c. basing pts. (export) 2.50c. Phoenixville; Knoxville Iron Co. 2.30c. basing points; Kaiser Co. 3.20c. f.o.b. Los Angeles.

Rails, per gross ton—Sweet Steel Co. (rail steel) $50 mill; West Virginia Rail Co. (lightweight) on allocation based Huntington, W. Va.; Colorado Fuel & Iron, $45 Pueblo.

Hot Rolled Plate—Granite City Steel Co. 2.85c. produced on DPC eqpt., 2.35c. otherwise; Knoxville Iron Co. 2.25c. basing pts.; Kaiser Co. and Geneva Steel Co. 3.20c. Pacific Ports; Central Iron and Steel Co. 2.50c. basing points; Granite City Steel Co. 2.35c. Granite City.

Merchant Bars—W. Ames Co., 10 tons and over, 2.85c. mill; Eckels-Nye Steel Corp. 2.50c. basing pts. (rail steel) 2.40c.; Phoenix Iron Co. 2.40c. basing pts.; Sweet Steel Co. (rail steel) 2.33c. mill; Joslyn Mfg. & Supply Co., 2.35c. Chicago; Calumet Steel Div., Borg Warner Corp. (8 in. mill bar), 2.35c. Chicago; Knoxville Iron Co., 2.30c. basing pts.; Laclede Steel Co., sales to LaSalle Steel granted Chicago base, f.ob Madison, Ill.; Milton Mfg. Co., 2.75c. f.o.b. Milton, Pa.

Pipe Skelp—Wheeling Steel, Benwood, 2.05c.

Reinforcing Bars—W. Ames & Co., 10 tons and over, 2.85c. mill; Sweet Steel Co. (rail steel), 2.33c. mill; Columbia Steel Co., 2.50c. Pacific Ports.

Cold Finished Bars—Keystone Drawn Steel Co. on allocation, Pittsburgh e.f. base plus c/l freight on hot rolled bars Pittsburgh to Spring City, Pa.; New England Drawn Steel Co. on allocation outside New England, Buffalo e.f. base plus c/l freight Buffalo to Mansfield, Mass., f.o.b. Mansfield; Empire Finished Steel Corp. on allocation outside New England, Buffalo e.f. base plus c/l freight Buffalo to plants, f.o.b. plant; Compressed Steel Shafting Co. on allocation outside New England, Buffalo base plus c/l freight Buffalo to Readville, Mass., f.o.b. Readville; Medart Co. in certain areas, Chicago e.f. base plus c/l freight Chicago to St. Louis, f.o.b. St. Louis.

Alloy Bars—Texas Steel Co., for delivery except Texas and Okla., Chicago base, f.o.b. Fort Worth, Tex.; Connors Steel Co., shipped outside Ala., Mississippi, Louisiana, Georgia, Florida, Tenn., Pittsburgh base, f.o.b. Birmingham.

Hot Rolled Strip—Joslyn Mfg. & Supply Co., 2.30c. Chicago; Knoxville Iron Co., 2.25c. basing pts.

Hot Rolled Sheets—Andrews Steel Co., Middletown base on shipments to Detroit or area; Parkersburg Iron & Steel, 2.25c. Parkersburg. Granite City Steel 2.45c.

Galvanized Sheets—Andrews Steel Co. 3.75c. basing pts.; Parkersburg Iron & Steel Co., 3.85c. Parkersburg; Continental Steel Co., Middletown base on Kokomo, Ind., product; Superior Sheet Steel Co., Pittsburgh base except for Lend-Lease.

Pipe and Tubing—South Chester Tube Co. when priced at Pittsburgh, freight to Gulf Coast and Pacific Ports may be charged from Chester, Pa., also to points lying west of Harrisburg, Pa.

Black Sheets—Empire Sheet and Tinplate Co., maximum base price mill is 2.45c. per 100 lb., with differentials, transportation charges, etc., provided in RPS. No. 6.

Wire Products—Pittsburgh Steel Co., f.o.b. Pittsburgh, per 100 lb., rods, No. 5 to 9/32 in., 2.20c.; rods, heavier than 9/32, 2.35c.; bright wire, 2.725c.; bright nails, 2.90c.; lead and furnace annealed wire, 2.85c.; pot annealed wire, 2.85c.; galvanized barbed wire, 3.90c.; plain staples, 2.55c.; galvanized staples, 2.65c.; bright spring wire, 3.30c.; galvanized spring wire, 3.45c.

MACHINED BRONZE BEARINGS
GRAPHITED AND OILLESS
BRONZE BEARINGS
BRONZE GEAR BLANKS
MACHINED BRONZE PARTS

S & H Bronze Bearings are made of cast bronze, under the most modern conditions and of specifications to meet the most exacting requirements. We are manufacturers of plain bronze and graphited and oilless bronze bearings for all branches of the Government Services, as well as plain cylinder type, single and double flange, thrust washers, from ⅜" in diameter to 20" in diameter. We also manufacture special parts made of cast bronze. Our manufacturing methods and equipment enable us to meet the most exacting machining specifications.

If it's Bronze BETTER B BEARINGS *We make it*

INDUSTRIAL BEARINGS

S. & H. Bearing and Manufacturing Co.
340-344 North Avenue, East
Cranford New Jersey

WHY not let "HERCULES" (Red-Strand) Wire Rope help you meet present day production requirements and still maintain a reasonable margin of profit? You will quickly discover that "HERCULES" is a dependable ally—not only in today's fight against increasing operating costs—but also in your endeavor to speed up production.

Made Only By **A. LESCHEN & SONS ROPE CO.** *Established 1857*
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New York • Chicago • Denver • San Francisco • Seattle • Portland

PIG IRON PRICES

BASING POINT* BASE PRICES

Basing Point	Basic	No. 2 Foundry	Malleable	Bessemer	Low Phos.
Bethlehem	$25.50	$26.00	$26.50	$27.00	.....
Birdsboro	25.50	26.00	26.50	27.00	$30.50
Birmingham	20.00	21.38	.....	26.00	.....
Buffalo	24.00	25.00	25.50	26.00	30.50
Chicago	24.50	25.00	25.00	25.50	.....
Cleveland	24.50	25.00	25.00	25.50	.....
Detroit	24.50	25.00	25.00	25.50	.....
Duluth	25.00	25.50	25.50	26.00	.....
Erie	24.50	25.00	25.50	26.00	.....
Everett	25.50	26.00	26.50	27.00	.....
Granite City	24.50	25.00	25.00	25.50	.....
Hamilton	24.50	25.00	25.00	.....	.....
Neville Island	24.50	25.00	25.00	25.50	.....
Provo	22.50	23.00	.....	.....	.....
Sharpsville[1]	24.50	25.00	25.00	25.50	.....
Sparrows Point	25.50	26.00	.....	.....	.....
Steelton	25.50	.....	.....	.....	30.50
Swedeland	25.50	26.00	26.50	27.00	.....
Toledo	24.50	25.00	25.00	25.50	.....
Youngstown	24.50	25.00	25.00	25.50	.....

DELIVERED PRICES† (BASE GRADES)

Consuming Point	Basing Point	Freight Rate	Basic	No. 2 Foundry	Malleable	Bessemer	Low Phos.
Boston	Everett	$ .50	$26.00	$26.50	$27.00	$27.50	.....
Boston	Birdsboro-Steelton	4.02	.....	.....	.....	.....	$34.52
Brooklyn	Bethlehem	2.50	28.00	28.50	29.00	29.50	.....
Brooklyn	Birdsboro	2.92	.....	.....	.....	.....	33.42
Canton	Cleveland	1.39	25.89	26.39	26.39	26.89	.....
Canton	Buffalo	3.19	.....	.....	.....	.....	33.69
Cincinnati	Birmingham	4.06	24.06	25.44	.....	.....	.....
Cincinnati	Hamilton	1.11	.....	.....	26.11	.....	.....
Cincinnati	Buffalo	4.40	.....	.....	.....	.....	34.90
Jersey City	Bethlehem	1.53	27.03	27.53	28.03	28.53	.....
Jersey City	Birdsboro	1.94	.....	.....	.....	.....	32.44
Los Angeles	Provo	4.95	27.45	27.95	.....	.....	.....
Los Angeles	Buffalo	15.41	.....	.....	.....	.....	45.91
Mansfield	Cleveland & Toledo	1.94	26.44	26.94	26.94	27.44	.....
Mansfield	Buffalo	3.36	.....	.....	.....	.....	33.86
Philadelphia	Swedeland	.84	26.34	26.84	27.34	27.84	.....
Philadelphia	Birdsboro	1.24	.....	.....	.....	.....	31.74
San Francisco	Provo	4.95	27.45	27.95	.....	.....	.....
San Francisco	Buffalo	15.41	.....	.....	.....	.....	45.91
Seattle	Provo	4.95	27.45	27.95	.....	.....	.....
Seattle	Buffalo	15.41	.....	.....	.....	.....	45.91
St. Louis	Granite City	.50	25.00	25.50	25.50	26.00	.....
St. Louis	Buffalo	7.07	.....	.....	.....	.....	37.57

* Maximum per gross ton, established by OPA February 14, 1945. † Prices do not reflect 3 per cent tax on freight.

(1) Struthers Iron & Steel Co., Struthers, Ohio, may charge 50c. a ton in excess of basing point prices for No. 2 foundry, basic, bessemer and malleable.

Charcoal pig iron base prices for Lyles, Tenn., and Lake Superior furnaces, $33.00 and $34.00, respectively. Newberry Brand of Lake Superior charcoal iron $39.00 per g.t., f.o.b. furnace, by order L 39 to RPS 10, April 11, 1945, retroactive to March 7, 1945. Delivered to Chicago, $42.34. High phosphorus iron sells at Lyles, Tenn., at $28.50.

Basing point prices are subject to switching charges; Silicon differentials (not to exceed 50c. a ton for each 0.25 per cent silicon content in excess of base grade which is 1.75 to 2.25 per cent); Phosphorus differentials, a reduction of 38c. per ton for phosphorus content of 0.70 per cent and over; Manganese differentials, a charge not to exceed 50c. per ton for each 0.50 per cent manganese content in excess of 1.00 per cent. Effective March 3, 1943, $2 per ton extra may be charged for 0.5 to 0.75 per cent nickel content and $1 per ton extra for each additional 0.25 per cent nickel.

Silvery iron and bessemer ferrosilicon up to and including 14.00 per cent silicon covered by RPS 10 as amended Feb. 14, 1945. Silvery iron, silicon 6.00 to 6.50 per cent, C/L per G.T., f.o.b. Jackon, Ohio—$30.50; f.o.b. Buffalo—$31.75. Add $1.00 per ton for each additional 0.50% Si. Add 50c. per ton for each 0.50% Mn over 1.00%. Add $1.00 per ton for 0.75% or more P. Bessemer ferrosilicon prices are $1.00 per ton above silvery iron prices of comparable analysis.

METAL POWDERS

Prices are based on current market prices of ingots plus a fixed figure. F.o.b. shipping point, ¢ per lb, ton lots.

Copper, electrolytic, 150 and 200 mesh	21½¢ to 23½¢
Copper, reduced, 150 and 200 mesh	20½¢ to 25½¢
Iron, commercial, 100 and 200 mesh 96 + % Fe	12½¢ to 15¢
Iron, crushed, 200 mesh and finer, 90 + % Fe carload lots	4¢
Iron, hydrogen reduced, 300 mesh and finer, 98½ + % Fe, drum lots	63¢
Iron, electrolytic, unannealed, 300 mesh and coarser, 99 + % Fe	30 to 33¢
Iron, electrolytic, annealed minus 100 mesh, 99 + % Fe	42¢
Iron carbonyl, 300 mesh and finer, 98-99.8 + % Fe	90¢
Aluminum, 100 and 200 mesh	*25¢
Antimony, 100 mesh	30¢
Cadmium, 100 mesh	$1.40
Chromium, 100 mesh and finer	$1.25
Lead, 100, 200 & 300 mesh	11½ to 15¢
Manganese	65¢
Nickel, 150 mesh	51½¢
Solder powder, 100 mesh	8½¢ plus metal
Tin, 100 mesh	58¾¢
Tungsten metal powder, 98%-99%, any quantity, per lb	$2.60
Molybdenum powder, 99%, in 200-lb kegs, f.o.b. York, Pa., per lb.	$2.60
Under 100 lb	$3.00

*Freight allowed east of Mississippi.

COKE

Furnace, beehive (f.o.b. oven)	Net Ton
Connellsville, Pa.	$7.50*
Foundry, beehive (f.o.b. oven)	
Fayette Co., W. Va.	8.10
Connellsville, Pa.	9.00
Foundry, By-Product	
Chicago, del'd	13.35
Chicago, f.o.b.	12.60
New England, del'd	14.25
Kearny, N. J., f.o.b.	13.65
Philadelphia, del'd	12.88
Buffalo, del'd	13.00
Portsmouth, Ohio, f.o.b.	11.10
Painesville, Ohio, f.o.b.	11.75
Erie, del'd	12.75
Cleveland, del'd	12.80
Cincinnati, del'd	12.85
St. Louis, del'd	13.85
Birmingham, del'd	10.50

***Hand drawn ovens using trucked coal permitted to charge $8.00 per ton plus transportation charges.**

Are your mechanical developments in the stage where you are searching for just the right kind of spring? Then call on B-G-R engineers for advice on choice of material, type of action, and correct design—for economy in manufacture and ease of operation. Be guided by B-G-R—it pays!

BGR Springs · Wire Forms · Small Stampings
BARNES-GIBSON-RAYMOND
DIVISION OF ASSOCIATED SPRING CORPORATION
TWO PLANTS FOR SPRING SERVICE
DETROIT ANN ARBOR MICHIGAN

PRICES

BOLTS, NUTS, RIVETS, SET SCREWS

Bolts and Nuts

(F.o.b. Pittsburgh, Cleveland, Birmingham or Chicago)

Machine and Carriage Bolts:

Base discount less case lots

	Per Cent Off List
½ in. & smaller x 6 in. & shorter	65½
9/16 & ⅝ in. x 6 in. & shorter	63½
¾ to 1 in. x 6 in. & shorter	61
1⅛ in. and larger, all lengths	59
All diameters over 6 in. long	59
Lag, all sizes	62
Plow bolts	65

Nuts, Cold Punched or Hot Pressed

(Hexagon or Square)

½ in. and smaller	62
9/16 to 1 in. inclusive	59
1⅛ to 1½ in. inclusive	57
1⅝ in. and larger	56

On above bolts and nuts, excepting plow bolts, additional allowance of 10 per cent for full container quantities. There is an additional 5 per cent allowance for carload shipments.

Semi-Fin. Hexagon Nuts	U.S.S.	S.A.E.
Base discount less keg lots		
7/16 in. and smaller	..	64
½ in. and smaller	62	..
⅝ in. through 1 in.	..	60
9/16 in. through 1 in.	59	..
1⅛ in. through 1½ in.	57	58
1⅝ in. and larger	56	..

In full keg lots, 10 per cent additional discount.

Stove Bolts	*Consumer*
Packages, nuts loose	71 and 10
In packages, with nuts attached	71
In bulk	80

On stove bolts freight allowed up to 65c. per 100 lb. based on Cleveland, Chicago, New York on lots of 200 lb. or over.

Large Rivets

(½ in. and larger)

	Base per 100 Lb.
F.o.b. Pittsburgh, Cleveland, Chicago, Birmingham	$3.75

Small Rivets

(7/16 in. and smaller)

	Per Cent Off List
F.o.b. Pittsburgh, Cleveland, Chicago, Birmingham	65 and 5

Cap and Set Screws	*Consumer Per Cent Off List*
Upset full fin, hexagon head cap screws, coarse or fine thread, up to and incl. 1 in. x 6 in.	64
Upset set screws, cup and oval points	71
Milled studs	46
Flat head cap screws, listed sizes	36
Fillister head cap, listed sizes	51

Freight allowed up to 65c. per 100 lb. based on Cleveland, Chicago or New York on lots of 200 lb. or over.

ROOFING TERNE PLATE

(F.o.b. Pittsburgh, 112 Sheets)

	20x14 in.	20x28 in.
8-lb. coating I.C.	$6.00	$12.00
15-lb. coating I.C.	7.00	14.00
20-lb. coating I.C.	7.50	15.00

ELECTRICAL SHEETS

(Base, f.o.b. Pittsburgh)

	Per Lb.
Field grade	3.30c.
Armature	3.65c.
Electrical	4.15c.
Motor	5.05c.
Dynamo	5.75c.
Transformer 72	6.25c.
Transformer 65	7.25c.
Transformer 58	7.75c.
Transformer 52	8.55c.

F.o.b. Granite City, add 10c. per 100 lb. on field grade to and including dynamo. Pacific ports add 75c. per 100 lb. on all grades.

SMOOTH ACTION FOR AIR OPERATED UNITS . . .

Correct working pressure means smoother, better operation of pneumatic equipment, and often the correct pressure is considerably less than full line pressure. Hannifin Pressure Regulating Valves provide the accurate sensitive reduction of air pressures that helps operators get the most from pneumatic machinery. Hannifin piston-type design provides instant adjustment over the entire pressure range from 150 lbs. down. Long valve stem travel in this design gives large volumetric capacity to meet fluctuating demand with minimum restriction to flow. Write for Regulator Bulletin 56 with full description. Hannifin Manufacturing Company, 625-631 So. Kolmar Avenue, Chicago 24, Illinois.

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PRESSURE REGULATING VALVES

No other saw can do as much!

No Other Saw Can Do As Much!

MARVEL Universal Band Saw, 18" x 18" capacity, will cut-off, rough-out, or split bar stock, pipe, structural sections, mouldings, tubing, large standard shapes, or small irregular shapes with speed, ease, and convenience. Few shops working with metal can afford to be without this most versatile of all saws.

MARVEL SAWS

Mitre cutting is simple and accurate with the MARVEL Series 8 Band Saw. No change in position of work. Simply set the saw column at any required angle up to 45° either right or left of vertical. Do not confuse with any other "band saw". There is no other machine like the MARVEL.

Complete Range of Metal Sawing Machines

Being the largest exclusive manufacturer of metal sawing machines and blades, both hack saw and band saw type, we have the correct answer to your cut-off problems. Each MARVEL model has a distinct application, so write us and we will send our catalog, price and recommendation for the saw to fill your requirements most efficiently. MARVEL sawing engineers are also available to discuss and analyze your cut-off work. (Without obligation of course)

ARMSTRONG-BLUM MFG. CO.

5700 W. Bloomingdale Ave., Chicago 39, Illinois, U. S. A.

Ferromanganese

78-82% Mn, maximum contract base price per gross ton, lump size, f.o.b. car at Baltimore, Philadelphia, New York, Birmingham, Rockdale, Rockwood, Tenn.

Carload lots (bulk)	$135.00
Carload lots (packed)	141.00
Less ton lots (packed)	148.50

$1.70 for each 1% above 82% Mn; penalty, $1.70 for each 1% below 78%.

Manganese Metal

Contract basis, lump size, per lb. of metal, f.o.b. shipping point with freight allowed. Spot sales add 2c. per lb.

96-98% Mn, .2% max. C, 1% max. Si, 2% max. Fe.

Carload, bulk	36c.
L.c.l. lots	38c.

95-97% Mn, .2% max. C, 1.5% max. Si, 2.5% max. Fe.

Carload, bulk	34c.
L.c.l. lots	35c.

Spiegeleisen

Maximum base, contract prices, per gross ton, lump, f.o.b. Palmerton, Pa.

	16-19% Mn 3% max Si	19-21% Mn 3% max Si
Carloads	$35.00	$36.00
Less ton	47.50	48.50

Electric Ferrosilicon

OPA maximum base price cents per lb. contained Si, lump size in carloads, f.o.b. shipping point with freight allowed.

	Eastern Zone	Central Zone	Western Zone
50% Si	6.65c.	7.10c.	7.25c.
75% Si	8.05c.	8.20c.	8.75c.
80-90% Si.	8.90c.	9.05c.	9.55c.
90-95% Si.	11.05c.	11.20c.	11.65c.

Spot sales add: 45c. per lb. for 50% Si, .3c. per lb. for 75% Si, .25c. per lb. for 80-90% and 90-95% Si.

Silvery Iron

Silvery Iron, Silicon 14.01 to 14.50 per cent, $45.50 per G. T. f.o.b. Jackson, Ohio. Add $1.00 per ton for each additional 0.50% Si up to and including 18%. Add $1.00 per ton for low impurities, not to exceed: P—0.05%, S—0.04%, C—1.00%. Covered by MPR 405.

Silicon Metal

OPA maximum base price per lb. of contained Si, lump size, f.o.b. shipping point with freight allowed to destination, for l.c.l. above 2000 lb., packed. Add .25c. for spot sales.

	Eastern Zone	Central Zone	Western Zone
96% Si, 2% Fe	13.10c.	13.55c.	16.50c.
97% Si, 1% Fe	13.45c.	13.90c.	16.80c.

Ferrosilicon Briquets

OPA maximum base price per lb. of briquet, bulk, f.o.b. shipping point with freight allowed to destination. Approximately 40% Si. Add .25c. for spot sales.

	Eastern Zone	Central Zone	Western Zone
Carload, bulk	3.35c.	3.50c.	3.65c.
2000 lb-carload	3.8c.	4.2c.	4.25c.

Silicomanganese

Contract basis lump size, per lb. of metal, f.o.b. shipping point with freight allowed. Add .25c. for spot sales. 65-70% Mn, 17-20% Si, 1.5% max. C.

Carload, bulk	6.05c.
2000 lb. to carload	6.70c.
Under 2000 lb.	6.90c.
Briquets, contract, basis carlots, bulk freight allowed, per lb.	5.80c.
2000 lb. to carload	6.30c.
Less ton lots	6.55c.

Ferrochrome

(65-72% *Cr.* 2% *max. Si*)

OPA maximum base contract prices per lb. of contained Cr, lump size in carload lots, f.o.b. shipping point, freight allowed to destination. Add .25c. per lb. contained Cr for spot sales.

	Eastern Zone	Central Zone	Western Zone
0.06% C	23.00c.	23.40c.	24.00c.
0.10% C	22.50c.	22.90c.	23.50c.
0.15% C	22.00c.	22.40c.	23.00c.
0.20% C	21.50c.	21.90c.	22.50c.
0.50% C	21.00c.	21.40c.	22.00c.
1.00% C	20.50c.	20.90c.	21.50c.
2.00% C	19.50c.	19.90c.	21.00c.
66-71% Cr, 4-10%	13.00c.	13.40c.	14.00c.
62-66% Cr, 5-7% C	13.50c.	13.90c	14.50c.

High-Nitrogen Ferrochrome

Low-carbon type: 67-72% Cr, 0.75% N. Add 2c. per lb. to regular low-carbon ferrochrome price schedule. Add 2c. for each additional 0.25% N. High-carbon type: 66-71% Cr, 4-5% C, 0.75% N. Add 5c. per lb. to regular high-carbon ferrochrome price schedule.

Low-Carbon Ferromanganese

Contract prices per lb. of manganese contained, lump size, f.o.b. shipping point, freight allowed to destination, Eastern Zone. Add 0.25c. for spot sales.

	Carloads, Bulk	Ton Lots	Less Ton
0.10% max. C, 1 or 2% max. Si	23.00c.	23.40c.	23.65c.
0.15% max. C, 1 or 2% max. Si	22.00c.	22.40c.	22.65c.
0.30% max. C, 1 or 2% max. Si	21.00c.	21.40c.	21.65c.
0.50% max. C, 1 or 2% max. Si	20.00c.	20.40c.	20.65c.
0.75% max. C, 7.00% max. Si	16.00c.	16.40c.	16.65c.

Ferrochrome Briquets

Contract prices per lb. of briquet, f.o.b. shipping point, freight allowed to destination. Approx. 60 per cent contained chromium. Add 0.25c. for spot sales.

	Eastern Zone	Central Zone	Western Zone
Carload, bulk	8.25c.	8.55c.	8.95c.
Ton lots	8.75c.	9.25c.	10.75c.
Less ton lots	9.00c.	9.50c.	11.00c.

Ferromanganese Briquets

Contract prices per lb. of briquet, f.o.b. shipping point, freight allowed to destination. Approx. 66 per cent contained manganese. Add 0.25c. for spot sales.

	Eastern Zone	Central Zone	Western Zone
Carload, bulk	6.05c.	6.30c.	6.60c.
Ton lots	6.65c.	7.55c.	8.55c.
Less ton lots	6.80c.	7.80c.	8.80c.

Calcium—Manganese—Silicon

Contract prices per lb. of alloy, lump size, f.o.b. shipping point, freight allowed to destination.

16-20% Ca, 14-18% Mn, 53-59% Si. Add 0.25c. for spot sales.

	Eastern Zone	Central Zone	Western Zone
Carloads	15.50c.	16.00c.	18.05c.
Ton lots	16.50c.	17.35c.	19.10c.
Less ton lots	17.00c.	17.35c.	19.60c.

Calcium Metal

Eastern zone contract prices per lb. of metal, f.o.b. shipping point, freight allowed to destination. Add 5c. for spot sales. Add 0.9c. for Central Zone; 0.49c. for Western Zone.

	Cast	Turnings	Distilled
Ton lots	$1.80	$2.30	$5.00
Less ton lots	2.30	2.80	5.75

Chromium—Copper

Contract price per lb. of alloy, f.o.b. Niagara Falls, freight allowed east of the Mississippi River. 8-11% Cr, 88-90% Cu, 1.00% max. Fe, 0.50% max. Si. Add 2c. for spot sales.

Shot or ingot	45c.

Ferroboron

Contract prices per lb. of alloy, f.o.b. shipping point, freight allowed to destination. Add 5c. for spot sales. 17.50% min. B, 1.50% max. Si, 0.50% max. Al, 0.50% max. C.

	Eastern Zone	Central Zone	Western Zone
Ton lots	$1.20	$1.2075	$1.289
Less ton lots	1.30	1.3075	1.329

Manganese—Boron

Contract prices per lb. of alloy, f.o.b. shipping point, freight charges allowed. Add 5c. for spot sales.

75.00% Mn, 15-20% B, 5% max. Fe, 1.50% max. Si, 3.00% max. C.

	Eastern Zone	Central Zone	Western Zone
Ton lots	$1.89	$1.903	$1.935
Less ton lots	2.01	2.023	2.055

Nickel—Boron

Spot and contract prices per lb. of alloy, f.o.b. shipping point, freight allowed to destination.

15-18% B, 1.00% max. Al, 1.50% max. Si, 0.50% max. C, 3.00% max. Fe, balance Ni.

	Eastern Zone	Central Zone	Western Zone
11,200 lb. or more	$1.90	$1.9125	$1.9445
Ton lots	2.00	2.09125	2.0445
Less ton lots	2.10	2.1125	2.1445

Other Ferroalloys

Ferrotungsten, Standard grade lump or ¼X down, packed, f.o.b. plant at Niagara Falls, New York, Washington, Pa. York, Pa., per lb. contained tungsten, 10,000 lb. or more	$1.90
Ferrovanadium, 35-55%, contract basis, f.o.b. producer's plant, usual freight allowances, per lb. contained Va.	
Open hearth	$2.70
Crucible	$2.80
Primos	$2.90
Cobalt, 97% min., keg packed, contract basis, f.o.b. producer's plant, usual freight allowances, per lb. of cobalt metal	$1.50
Vanadium pentoxide, 88-92% V_2O_5 technical grade, contract basis, any quantity, per lb. contained V_2O_5. Spot sales add 5c. per lb. contained V_2O_5	$1.10
Silcaz No. 3, contract basis, f.o.b. producer's plant with usual freight allowances, per lb. of alloy. (Pending OPA approval)	
Carload lots	25c.
2000 lb. to carload	26c.
Silvaz No. 3, contract basis, f.o.b. producer's plant with freight allowances, per lb. of alloy (Pending OPA approval)	
Carload lots	58c.
2000 lb. to carload	59c.
Grainal, f.o.b. Bridgeville, Pa., freight allowed 50 lb. and over, max. based on rate to St. Louis	
No. 1	87.5c.
No. 6	60c.
No. 79	45c.
Bortram, f.o.b. Niagara Falls	
Ton lots, per lb.	45c.
Less ton lots, per lb.	50c.
Ferrocolumbium, 50-60%, contract basis, f.o.b. plant with freight allowances, per lb. contained Cb.	
2000 lb. lots	$2.25
Under 2000 lb. lots	$2.30
Ferrotitanium, 40-45%, 0.10%C. max. f.o.b. Niagara Falls, N. Y., ton lots, per lb. contained Ti	$1.23
Less ton lots	$1.35
Ferrotitanium, 20-25%, 0.10%C. max., ton lots, per lb. contained titanium	$1.35
Less ton lots	$1.40
High-carbon ferrotitanium, 15%-20%, 6-8% carbon, contract basis, f.o.b. Niagara Falls, N. Y. freight allowed East of Mississippi River, north of Baltimore and St. Louis, per carload	$142.50
Ferrophosphorus, 18% electric or blast furnaces, f.o.b. Anniston, Ala., carlots, with $3 unitage freight equalled with Rockdale, Tenn., per gross ton	58.50
Ferrophosphorus, electrolytic 23-26%, carlots, f.o.b. Monsanto (Sigio), Tenn., $3 unitage freight equalized with Nashville, per gross ton	$75.00
Ferromolybdenum, 55-75%, f.o.b. Langeloth, Washington, Pa., any quantity, per lb. contained Mo.	95c.
Calcium molybdate, 40-45%, f.o.b. Langeloth and Washington, Pa., any quantity, per lb. contained Mo.	80c.
Molybdenum oxide briquets, 48-52% Mo. f.ob. Langeloth, Pa. per lb. contained Mo	80c.
Molybdenum oxide, in cans, f.o.b Langeloth and Washington, Pa. per lb. contained Mo	80c.
Zirconium, 35-40%, contract basis, f.o.b. producer's plant with freight allowances, per lb. of alloy. Add ¼c. for spot sales	
Carload lots	14c.
Zirconium, 12-15%, contract basis, lump f.o.b. plant usual freight allowances, per lb. of alloy	
Carload, bulk	4.6c.
Alsifer (approx. 20% Al, 40% Si and 40% Fe), contract basis, f.o.b. Niagara Falls, carload, bulk	5.75c.
Ton lots	7.25c.
Simanal (approx. 20% Si, 20% Mn, 20% Al), contract basis, f.o.b. Philo, Ohio, with freight not to exceed St. Louis rate allowed, per lb.	
Car lots	8.00c.
Ton lots	8.75c.
Less ton lots	9.25c.

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This Week in The IRON AGE

Vol. 156, No. 5 August 2, 1945

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Measurement and Control

INDUSTRY has been long aware of the vital part that measurement plays in control. Not merely is it essential in design and in the control of size and shape of product but in cost management, job evaluation and every other phase of the production of goods. Every industrial manager knows that what cannot be measured cannot be controlled. And that the first step in obtaining measurement is to establish fixed units of comparison.

The engineer has the edge on the economist and the financier in this business of measuring because engineering units are fixed, definite and unchanging. An inch, foot, mile, horsepower, pound, quart, erg and degree Fahrenheit are the same today as yesterday, last year or 50 years ago and will be the same tomorrow, whereas the dollar as a measure of value is seldom the same from year to year and indeed possesses the shrinking and expanding qualities of a toy balloon.

The fixed units that stay put are quantitative ones. But the economist in particular and everybody in general does business with quality as well as quantity, and here we run into trouble. For qualitative units generally have rubber in them. And when you try to measure a varying object with a variable unit, you, in effect, are gaging the circumference of a toy balloon with a rubber tape measure. This is one reason why the OPA boys have had such hard sledding, and why the public so often collides with their sled.

Take the case of this morning's breakfast. The wife being away, you drop in or preferably walk into the corner restaurant and order bacon and eggs. Whether you get them or not is something else again, but for the sake of getting this to the printer, we will be optimistic and assume you do.

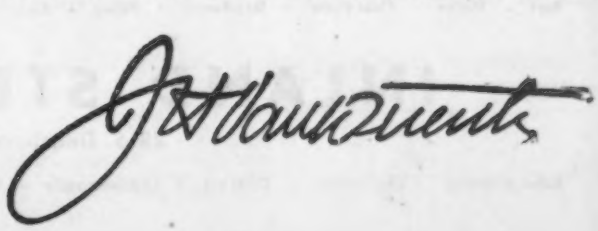
In plain sight on the wall is a placard showing the OPA schedule for this business. It fixes the price of bacon and eggs at exactly what you paid for bacon and eggs in 1942. Ostensibly the public has been protected and gives thanks.

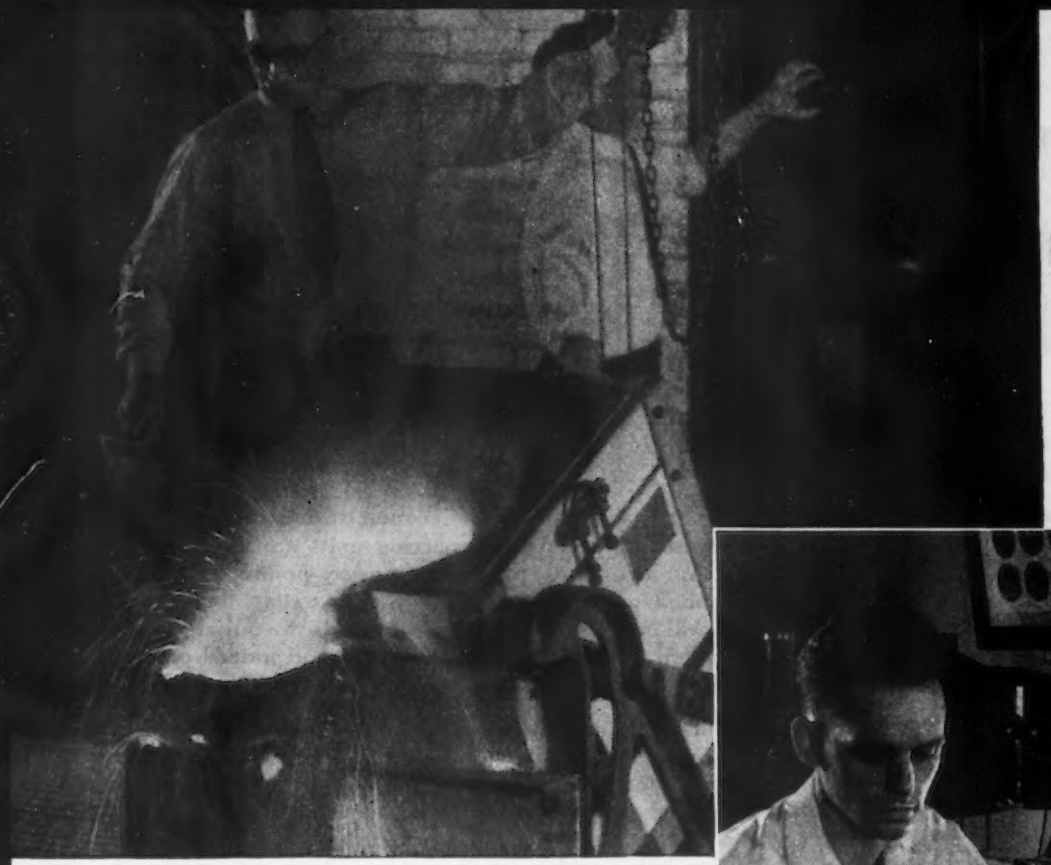
But the OPA fixes price only and it does not fix the actual value of that 1942 dollar that you are jingling in your jeans and which in fact is now worth 91¢ of that dollar, even when black market prices are excluded. That's rubber unit number one.

Nor does the OPA specify the number of strips of bacon that you shall get nor the size of the eggs that will be fried sunny side up. The qualitative measure is omitted. So you get two strips of bacon instead of four, and the diminutive eggs over in the corner of your plate are the result of child labor in the chicken family.

Yes, it looks at first glance as though the consumer had been protected by a far-seeing and beneficent government. Bacon and eggs in 1942, 40¢; bacon and eggs now at the same price. But actually if you measure what you get in calories of food value, and that is what you are supposed to be buying, the degree of inflation due to the shrinkage of both edibles and money may run from 50 to 100 pct. And the same thing applies to most of the things you buy that cannot be measured by the quart or pound, and some of them that can be.

If the average man and woman understood these things better, there would be less respect for some statistics and more sympathy for some statisticians.





Many test casts are made in Inland's search for new and better steels.

Invest in Victory—Buy More War Bonds and keep them.

Steel samples from pilot casts undergo photo-micrographic analysis.

New Inland Steels for Tomorrow

Inland makes steel in heats of a few pounds each for experimental purposes, and in production heats of 100 to 150 tons. The small experimental heats are run in two induction type furnaces, located in an especially equipped department of the main laboratory. These pilot heats are the forerunners of the steels for tomorrow.

Making small casts of steel is one phase of Inland's continuous research for better methods of producing steel, and for better steels *that* will make better products.

It is Inland research that already has produced low-alloy, high-yield strength Hi-Steel, and lead-bearing, faster machining Ledloy. The newest creation of Inland research is Ti-Namel—the new vitreous enameling alloy steel to which a white enamel cover coat is applied direct to the base metal. Ti-Namel assures superior quality finish, longer life, and lower shop costs.

These new Inland steels, and those that are yet to come, will be important to manufacturers competing in peacetime markets.

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The IRON AGE
July 31, 1945

NEWS FRONT

► Reports from Germany of the interest taken by American experts in German fuel injection systems indicate a revival of the system in this country. Though throughout the war our aircraft has been fueled by carburetion, the Germans have held out steadily for fuel injection.

It is highly probable that some system of fuel injection is already powering our attack on Japan, and American engineers are investigating further uses.

This development parallels the use of a cooling fan on our air-cooled aircraft engines, following the pioneering of such a fan on the only German air-cooled engine produced for aircraft during the war.

► Although the Hughes flying boat is scheduled to be in the air by the end of the year, the company itself considers wood construction inferior to metal, and does not look for wood to have much of a role in future aircraft construction.

► Indications now are that CMP will definitely last until Dec. 31. A main consideration in such retention is the protection of small quantity steel consumers who might be squeezed out in the grab for a marginal supply late this year.

► The Ford plant at Antwerp, which assembled 35,000 vehicles for the European campaign, is scheduled to start soon processing 400 a day for redeployment into the Pacific.

► Western manufacturers are becoming concerned over the volume of the provincial tub-thumping being done in their name in Washington and elsewhere. General feeling on the West Coast is that cheap steel, whoever produces it, is all that is wanted.

Fear of "monopoly" seems also to be stemming from Washington, as westerners seem to be willing enough to welcome any company to operate the steel and aluminum mills, as long as they bring a reasonable hope of steady jobs.

► The newest of the Kaiser-Frazer twins, bearing the latter name, is in a nebulous stage. Scheduled for production in the Graham plant in Detroit, it may resemble the Kaiser car in bearing a Continental engine, with possibly two more cylinders added, and turn up 100 plus hp.

► A new method of railroad car refrigeration shows great promise and will soon be experimentally tested. Devised by Railway Refrigeration Corp., New York, the equipment consists of two steel tanks, a cooling coil, and an expansion valve. There are no mechanically moving parts. Ammonia under pressure in one tank expands through the coils and is absorbed by the water in the other tank.

One charging of the ammonia tank will last for a cross-country trip, and the ammonia-water mixture is processed for ammonia recovery. The simplicity of the process and the extensive plans for servicing augur well for the process, as against a silica-gel method of some years ago which was never able to supplant the conventional use of ice.

► Figures prepared in England show that in the prewar period the British steel industry had an ingot cost index varying (by plants) between 70 and 100; German plants ranged between 84 and 86; French and Belgium plants were 89; United States plants varied from 80 to 95; and India had a figure of 70.

► Annual expenditures of $57,000,000 for research is predicted for about 150 colleges and universities in the U. S. which have organized programs in the natural sciences and engineering. These same programs accounted for $26,000,000 in 1939-40. The higher figure for the postwar period is based somewhat on desire, as in many instances funds are not yet available.

► Only OPA, WPB and the Office of Contract Settlement got any praise among the war agencies in the new Mead Committee report. Waste of manpower by the Army, depletion of iron ore and petroleum reserves and dilatory disposal of war surpluses draw a sharp fire of criticism.

► Pressure for a centralized inventory of surplus machine tools has now expanded to a full fledged Senate committee hearing on the problem of such an inventory for all surplus war goods.

Initial testimony indicates that pressure will be strong enough to overcome the obstacles of high administrative costs, manpower, and space.

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Operation of 4-Ton Openhearth

. . . Construction and operating characteristics of J & L's experimental 4-ton openhearth furnace, which has produced over 2100 tons of plain, medium, and high-carbon steels, free-cutting steels, and high-alloy-containing steels. Successive modifications of the original design are traced, and the reasons for the various alterations presented. The value of such a furnace as a research and development tool is discussed. Reproduced by courtesy of the AIME.

By H. K. WORK
Manager,
Research and Development Division,
and
W. R. WEBB
Research Engineer, Research and Development Division, Jones & Laughlin Steel Corp., Pittsburgh

o o o

THE experimental openhearth furnace discussed in this paper was installed in 1938 by the Jones & Laughlin Steel Corp. in its research and development laboratory at Pittsburgh. This furnace was described in a paper entitled "An Experimental Openhearth"* presented in 1939 before the 22nd Openhearth Conference of the American Institute of Mining and Metallurgical Engineers. In that paper was shown in detail the construction of the furnace and no attempt was made to discuss its operation, since, at that time, relatively few heats had been made.

Since May 1938, over 600 heats ranging in weight from 1000 lb to 8900 lb, representing 2100 tons of steel, have been produced, each with a special composition, as part of a particular investigation. Several important developments were made in this furnace, thereby indicating its value for research and development work. In fact it can be said that the value and performance of the experimental furnace exceeded all expectations.

The experimental furnace is quite different in many respects from a conventional openhearth unit. It is a continuous, one-way fired furnace employing a recuperator rather than a regenerative system for preheating the air and is equipped with an all basic roof. This furnace is illustrated in fig. 1. To the right are located the three burners which fire continuously, then the hearth itself, slag pocket and flue and the recuperator. The broken lines represent the original contour of the furnace and indicate the extent to which the furnace design has been altered.

Furnace Lines: Originally a square hearth was employed, with a slag line of 4 ft 6 in. on a side and with a dish-shaped bottom, having a bath depth of 12 in. This hearth permitted 1500 lb of metal to be charged, thereby producing a teemed ingot of 1000 lb, which was considered about the lower limit of ingot weight for making rimming steel. However, this did not prove entirely satisfactory. Due to the relatively great area of ladle refractories and larger radiating surface of the small ladles employed in relation to the volume of metal in the heats, they cool so rapidly during the tapping period as to result in frequent stopper freeze-ups and ladle skulls. Furthermore the ingots produced, due to the more rapid cooling, were not entirely representative of mill production. Therefore it became desirable to enlarge the hearth to accommodate larger heats. This was accomplished by dishing out the bottom and banks. At present the hearth measures 5 ft 8 in. on a side and is 20 in. deep and has a capacity for handling up to 8900 lb of metal. A heat of this size will produce an 8000-lb ingot and represents the limit of the present equipment.

Method of Firing: Three special gas burners are located at one end of the furnace. The burners were designed so as to give a short flame suitable for a furnace of this size. They consist of a 7-in. diameter air chamber and a 1¼-in. gas pipe. The position of the gas pipe may be adjusted axially within the air chamber so that proper combustion may be obtained. The fuel used for firing this furnace to date has been natural gas.

Recuperators: The recuperator itself as has been shown in fig. 1, is of the Fitch type. It consists of two horizontal banks of 18 carborundum tubes each, equipped with corebusters. The tubes are 6-in. outside diameter with a 1-in. wall thickness and are 4 ft 4 in. long. The entire recuperator structure is elevated on a solid concrete base to raise the lowest row of tubes several inches above the top of the slag pocket. This is to avoid attack by iron oxide carried out of the hearth by the waste gases. The exhaust gases flow upward around the outside of the tubes and escape through an 18-in. stack. Air is drawn into the front end of the upper bank of tubes in the opposite direction, by a 5-hp variable speed motor driven fan. This air, which in normal operation is heated to a temperature of approximately 1100°F, is conducted, through a well insulated pipe 12½-in. inside diameter, to a cross main above the three burners. The burners are connected to this pipe by separate 7-in. inside diameter pipes, equipped with manually operated valves.

During the operation of the furnace, a few minor changes were necessary in the recuperator. In 1939, after 167 heats had been made, two of the carborundum tubes in the lower section were replaced and two others were blocked off. At the same time, the

* THE IRON AGE, *May* 4, 1939, *p.* 58. *"An Experimental Openhearth Furnace," by H. K. Work and H. M. Banta, 22nd Openhearth Proceedings, AIME,* 1939, *pp.* 161-174.

concrete base of the recuperator was cut out to extend the slag pocket under the tubes. During the next furnace shutdown, the bottom row of three carborundum tubes, was removed entirely from the lower section. It was found that these three tubes were constantly being attacked by the iron oxide and slag carried over from the hearth.

In 1940, new recuperator blocks were laid in the bottom section to accommodate 15 tubes and the old blocks were employed for the 18 tubes in the top section. A carrying arch was built between the two sections so that the lower section could be replaced without disturbing the upper section. A brick baffle was then constructed in the slag pocket in order to reduce further the cutting action of the flue gases and suspended oxides on the lower rows of tubes. Replacements of tubes, wall brick and baffles were made at various times, but the recuperator remains essentially the same as it was originally, except for the elimination of the bottom row of three tubes.

In 1940 a pump was installed to raise the gas pressure and volume. Increasing the capacity of the furnace made this pump desirable since it allowed a greater flow of gas to the furnace. To provide additional air from the recuperator for proper combustion of this increased gas volume, the blower had to be speeded up considerably. In this connection, if the furnace were being redesigned, it probably would be desirable to have the bottom three recuperator tubes restored, as originally intended, but the lower section should be raised sufficiently to escape the cutting action of the flue gases. This would allow additional passage of preheated air through the lower section of the recuperators, thereby decreasing the load on the blower.

Refractories: Originally the laboratory openhearth had a conventional silica brick roof with a maximum arch of 4 ft 5 in. During the first year of operation, 227 heats were made under this silica roof. These heats were made progressively larger from approximately 1200 lb to a maximum of 3000 lb. As the heats were made larger, it became more difficult to maintain proper operating temperatures, which resulted in an increased number of furnace and ladle skulls. Hence it was decided that temperatures up to 3100°F were necessary. Since temperatures exceeding 3000°F are above the safe working limit for silica refractories, it was decided to replace the silica brick roof with a basic roof of chrome-magnesite brick. In doing this it seemed advisable to raise the roof arch to a 6 ft 9-in. span in order to make a more stable arch since chrome-magnesite brick has a lower load carrying ability and is approximately 60 pct heavier than silica brick.

Seventy-two heats, ending with heat 299, were made under this basic roof. A considerable improvement was noted in the working of the heats, with the furnace temperature often reaching 3200°F. Unfortunately, the chrome-magnesite brick spalled appreciably and affected the slag composition. The chromium, upon being reduced, entered the metallic bath. Thus, some of these heats contained an excessive amount of chromium. Much of this spalling difficulty was no doubt due to temperature fluctuations caused by the intermittent operation of the furnace. To minimize the reduction of chromium from the basic brick, the chrome-magnesite roof was replaced with an improved Metalkase magnesite roof low in chromium content. As a further precaution against spalling, the brick were covered 1-in. thick, with a burnt mica insulating cement. This roof performed very satisfactorily standing, without injury, temperatures 150°F or more above the safe limit for silica brick. After 52 heats were made, the roof appeared rather thin. The mica insulation was removed and 1 in. of fire clay "splits" were laid over the roof. This repair with several additional patches to the insulating cover lasted for an additional 122 heats after which the roof was completely rebuilt with Metalkase magnesite brick. Starting with heat 474, this roof, minus insulation, lasted for 130 heats. Again the roof was replaced with Metalkase magnesite brick and at the time of writing this paper, 42 heats have been produced.

Basic roofs have been in service for five years on the furnace and 415 heats were made under this type roof. This afforded an excellent opportunity to study the characteristics and behavior of these refractories under the most adverse conditions. The experimental furnace operates intermittently and the temperature fluctuates between 2100°F and 3200°F during the working of a single heat. In view of these severe conditions, the behavior of the basic roof is considered very good.

Not too much significance should be attached to the exact number of heats produced under each basic roof since the prime consideration of the laboratory furnace is to produce experimental steels of representative quality. As is true with all small production units, to do this high temperatures and furnace control are of fundamental importance. Without them, as was the case with the silica roof, manipulation and adjustments of furnace practices are so narrowed that the melter is seriously handicapped. Therefore, during roof rebuilds, frequently a patch would have been sufficient for practical operations, but to assure the above conditions, the entire roof structure was replaced.

The principal advantage of the basic roof is that higher temperatures are permissible. This reduces the furnace time and fuel consumption required to melt down and work the heats. The disadvantages of the basic

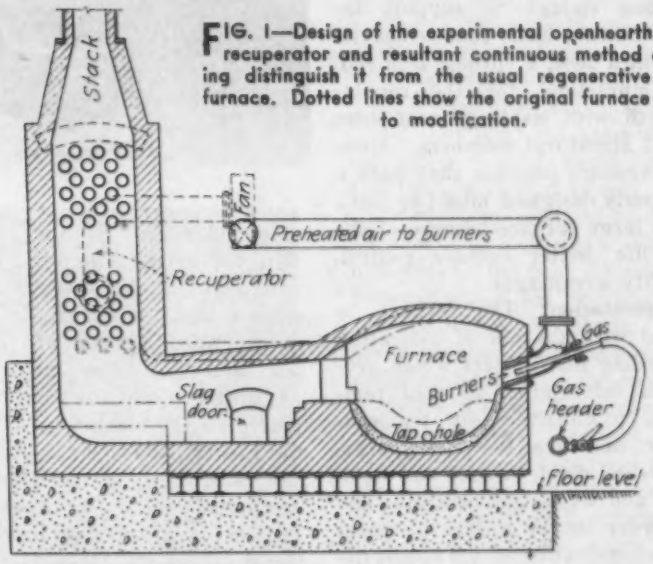


FIG. 1—Design of the experimental openhearth. The recuperator and resultant continuous method of firing distinguish it from the usual regenerative type furnace. Dotted lines show the original furnace prior to modification.

FIG. 2—Killed slab and billet ingots of the size shown here are now being poured in the laboratory shop. Rimming ingots of this size are also produced. These ingots are sufficiently large to be rolled on the blooming mill and subsequently handled in any of the finishing departments.

brick are its greater weight, increased brick cost, lack of load strength and its tendency to spall. In the laboratory furnace, the roof span is small and the structural members are strong enough to support the weight. Since a basic roof is heavier than a silica roof, a sprung arch roof seems impractical for the regular openhearth with its large roof span and light structural members. However, it appears possible that such a roof properly designed, might be justified on a large furnace because of the greater life, better furnace control, and quality advantages.

Instrumentation: The furnace is controlled with the aid of indicating and recording instruments which provide such information as roof temperature, preheated air temperature, air and gas blow and pressures, air-fuel ratio, furnace and stack pressure and waste gas control. The CO_2 recorder serves a dual purpose: it gives an indication of the combustible gases escaping up the stack and also acts as a detector of waste gases entering the preheated air line to the burners. In this way, the operator is informed of damaged tubes in the recuperator and is able to seal them before they can seriously affect the steelmaking.

Carbanalyzer: The relatively rapid drop of carbon in this furnace made necessary some method for controlling the carbon. This prompted an investigation into the various methods used for determining carbon in steels and it was found that a relatively simple magnetic device could be made to give reproducible values. This ultimately resulted in the "Carbanalyzer."* This instrument was used extensively in the laboratory and as soon as sufficient data were accumulated it was also submitted to the mill for trial. The results of these tests showed that the carbanalyzer filled a need of the industry. The instrument was then placed on the market by the Fisher Scientific Co. and as of today more than 265 carbanalyzers are in current use in the steel industry. This is an interesting by-product of the work on the laboratory furnace.

Auxiliary Equipment: The steel is cast into mill-sized ingots for shaping and rolling by the regular steel mill equipment. For this reason, the usual practice is to melt a heat of 7000 lb to furnish enough metal for an 18x18-in. ingot for bar or tube investigations, a heat of 7900 lb. for a 12x30-in. ingot for plate and strip investigations, and a heat of 8900 lb for a 24x26-in. Gathman ingot for investigations that require a larger amount of steel. Fig. 27 shows these ingots. In addition to the standard ingots, a 4x4-in. ingot is cast from each heat. Should an indication of the large ingot's behavior in the mill or its physical characteristics be desired, this 4x4-in. ingot is rolled immediately to 1-in. or ⅝-in. square bars in the laboratory pilot rolling mills, otherwise it is stocked.

Raw Materials: In order to control the quality of the steel produced in these experimental investigations, it is desirable to have complete information about the raw materials charged. Hence the scrap consists of billets rolled from openhearth or bessemer steels. It is carefully selected and is marked by heat numbers and chemical composition. The pig iron, of different grades, is stored separately according to analysis. Since the practice used in the experimental furnace is to catch the carbon on the way down, it is necessary to proportion the charge in such a way that a suitable carbon content is obtained at melt-down, thereby permitting the proper working of the heat. A survey of heats made in the furnace shows that for the heats blocked at high-carbon, the ratio of pig iron to scrap is about 1.12, and for heats blocked at low-carbon, this ratio is about 0.9.

Fluxes: Slag control, as employed in the experimental furnace, consists principally of controlling the flux charge so that sufficient lime is present to more than take care of the silica in the metallic charge. Since the removal of impurities is related to the control of the carbon content, the slag characteristics are so controlled at this period that the impurities will be sufficiently oxidized by the time melting approaches completion. Originally, the flux charge consisted of limestone only, which amounted to approximately 11 pct of the total weight of the metallic charge. Using

*"*A New Instrument for the Magnetic Determination of Carbon in a Steel Bath,*" by H. K. Work and H. T. Clark, *Trans. AIME* v. 140, 1940, pp. 475-485.

this flux charge, it was found that the "lime boil" was excessive and the time required for the "lime up" was too long.

The flux charge at the present time consists of 6 pct to 8 pct limestone and approximately 1 pct of burnt lime for a total of 7 pct to 9 pct of the metallic charge. The ratio of CaO to SiO_2 in the slag at the end of the lime boil period should be about 2.5. Any deficiency in lime is added as necessary, based on the slag and bath conditions during the working period of the heat, the purpose being to form a high CaO to SiO_2 ratio slag during the final stages of the heat.

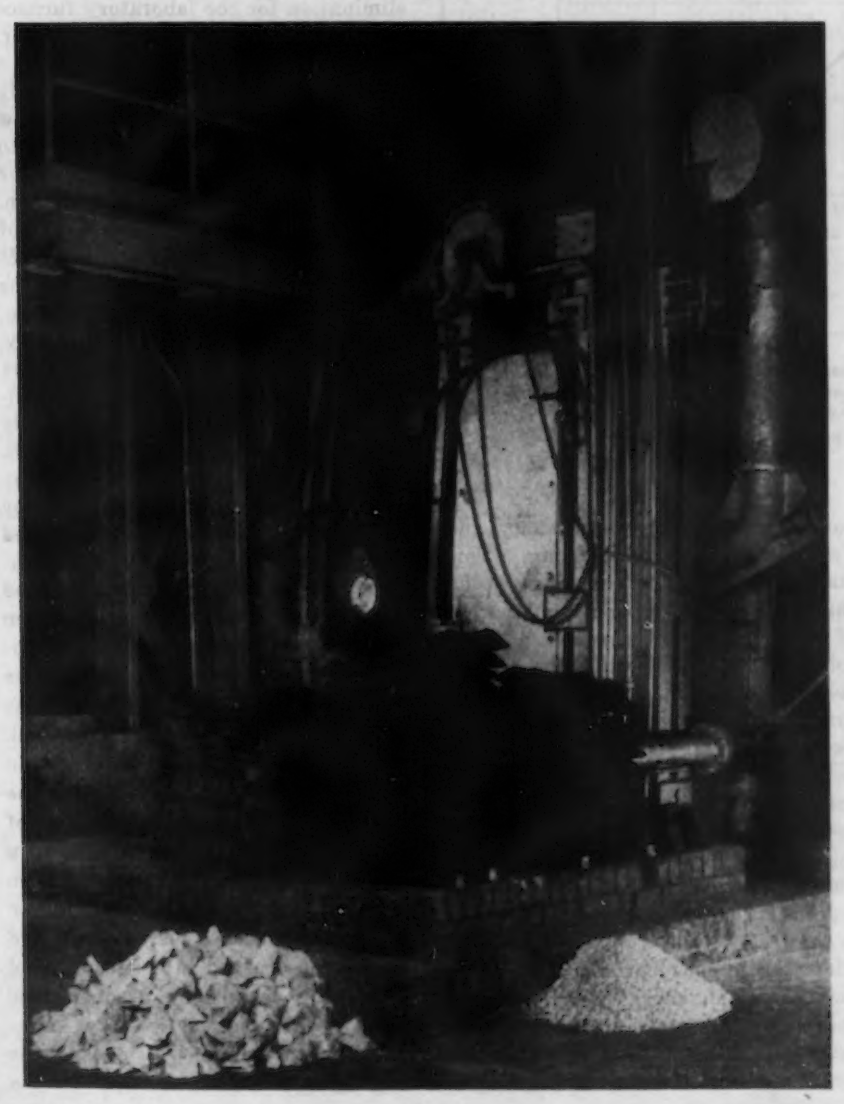
When steel of fairly low phosphorus content is desired, an amount of Staflux, equivalent to about 0.75 pct of the metallic charge, is added to raise the FeO content of the slag. This increases the ability of the slag to remove phosphorus. Fifty pounds of roll scale are charged with the Staflux for higher carbon heats. Typical examples of furnace charges for various grades of steel are given in table I and fig. 3 shows the furnace materials for one of these steels ready to be charged.

TABLE I
Typical Charges for Carbon Steels

Heat No.	C at Block, Pct	Charge, in Lb				
		Pig Iron	Scrap	Limestone	Staflux	Roll Scale
1	0.55	3700	3300	400	50	50
2	0.17	3500	3500	400	50	..
3	0.10	3400	3600	400	50	..
4	0.06	3300	3700	400	..	..

Charging the Furnace: The present charging practice employed for the experimental furnace is the result of considerable experience and will be briefly described. As previously stated, the furnace is intermittently operated and to avoid an exceptionally long melt-down period due to a cold hearth, the furnace temperature is gradually raised to about 3050°F before the charging operation is started. The furnace is drained and then flushed wih an air hose. This chills the exposed surface of the hearth and helps prevent the heat from melting soft. The tap hole is then sealed and the initial charge of stone and scrap is made. These additions are at the stage of incipient fusion before the pig iron addition is made. The pig iron is charged level. It has been found that level charging is essential for quick melting, rapid slag formation and reduction of gas oxidation. The total time required to charge the furnace is 1 hr 40 min. Charging is undoubtedly the most important single item affecting the operation of this furnace since deviations from the above practice almost always result in difficulty later on in the heat.

FIG. 3—A typical furnace charge of scrap, pig iron, limestone and burnt lime is shown ready for manual charging in front of the openhearth.



Melting Period: Upon completion of the iron charge, the final melt-down period begins. Throughout this period the flow of gas and air are kept at a maximum of 4900 and 54,000 cu ft per hr respectively under a positive furnace pressure of approximately 0.09 in. of water. The FeO, formed while the charge is melting by the excess oxygen of the burned gases oxidizing the scrap, is dissolved gradually and in turn oxidizes the silicon and the major part of the manganese in the bath. Some of the silica formed combines with the lime and some with the oxides of manganese and iron. If the basic elements are insufficient to combine with the silica, the slag will be glassy. This condition can be corrected by additions of burnt lime.

As the passage for the gases, over the hearth, becomes larger and larger due to the melting of the charge, the furnace pressure decreases until a constant value of 0.06 in. of water is reached. At this stage of the heat the charge is melted level. The average heat generally melts down level in about 3 hr, and it is desirable to have a melt-down carbon at this point, in the neighborhood of 1.20 pct for a high carbon heat and approximately

0.80 pct carbon for a low carbon heat. A study of those heats made under the basic roof show that the temperature, at the end of the melt-down period varies between 2980° and 3080°F with an average temperature of 3050°F.

As more scrap melts, and the hearth bottom becomes hotter, the calcination of the limestone increases rapidly, starting what is known as the lime boil. It is desirable to have the lumps of calcined limestone enter into solution as soon as they float up on the surface of the bath. Very often these lumps are covered with liquid silicates, thus preventing their going into solution. Generally fluorspar is considered the best material to cut these lumps, but in this furnace, fluorspar causes excess foaming of the slag, therefore sand or scale is preferred. The amount of sand or scale used for each application is 4 lb or 14 lb, respectively. When fluorspar is necessary, it is limited to 3 lb at any one time.

At the end of the boil, careful attention must be paid to working the heat, because the rate of carbon elimination in the experimental furnace is much more rapid than that of a conventional openhearth. In a large openhearth when a heat melts soft a "jigger" of molten iron is used to bring the carbon up again; this permits the reworking of the heat in the regular procedure. Such an operation is not practical in the experimental furnace since the bath will tend to freeze over then melt soft again; rather the type of raw materials and the method of charging are used to control the melt-down carbon.

No slag runoff arrangement is provided at present for the experimental furnace, therefore the only way to remove phosphorus from the bath is to increase the basicity and FeO percentage of the slag. This stabilizes the P_2O_5 in the slag. To do this 20 lb of Staflux or a combination of 15 lb of burnt lime and 8 lb of roll scale are added while the heat is being worked, until the desired slag condition is obtained. The amount of FeO in the slag is controlled within certain limits, as determined by the grade of steel produced. When the FeO content of the slag approaches the desired percentage only burnt lime is added. Finally, the phosphorus content of the bath is reduced to slightly less than that specified, to allow for a phosphorus pickup from the ferromanganese addition and phosphorus reversion during the deoxidation of the bath. The rather hot heats made in the experimental furnace favor phosphorus reversion, and to compensate for this, the slags are kept highly basic. The ratio of CaO to SiO_2 of the final slag is around 3.5. Since the bath is maintained at a high temperature, the slag will have the proper fluidity throughout the heat.

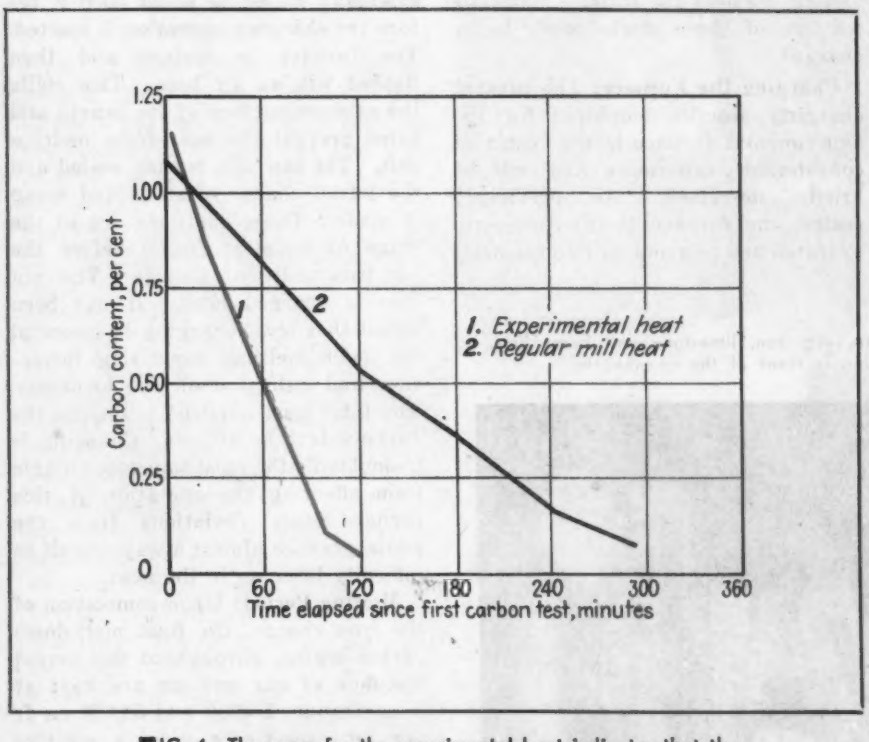


FIG. 4—The curve for the experimental heat indicates that the rate of carbon elimination is approximately 60 points per hr. The carbon drop for a typical 150-ton mill heat is reproduced for direct comparison.

The bath of the experimental furnace is rather shallow and the ratio of its hearth bottom area to its bath volume of metal is approximately 2.8. For the conventional openhearth of 100-ton to 150-ton capacity, this ratio is about 1. Since the CO formed by the reaction between the carbon and the FeO in the bath is largely generated in the form of bubbles and released to the bath at the hearth bottom, a most influential factor affecting the rate of carbon elimination is this ratio of hearth bottom area to the bath volume of metal. Fig. 4 gives a diagram of the rate of carbon elimination of a typical low carbon heat made in the experimental furnace. For comparison, the rate of carbon drop for a heat made in a 150-ton openhearth furnace is also included. Generally, the overall rate of carbon elimination for the laboratory furnace is around 60 points of carbon per hr, while the rate of carbon drop for a conventional furnace is considerably less. For heats to be finished at low carbon, ore is added, if necessary, to hasten the carbon elimination. For this purpose, wet lump ore 3 to 4 in. in size is preferable. These lumps of ore sink through the slag and react directly with the metal without the danger of being held by the basic slag.

Sampling the Metal: Ordinarily, standard fracture test samples are taken from the bath for preliminary chemical analysis periodically throughout the refining period. In this furnace, the rate of carbon drop is so rapid it is necessary to employ a method of rapid sampling, called plate sampling, particularly for high-carbon steels which cannot be drilled conveniently. A steel sample taken from the bath with an ordinary sampling spoon, is poured on the upper part of a cold steel plate sloped at an angle of about 15° to the vertical. The liquid steel solidifies in long thin strips as it flows down the face of the sloping plate. These thin strips of metal are immediately quenched in cold water, dried and cleaned with an air blast. Since the steel is high in carbon, the quenched test is quite hard and can be crushed in a special steel mortar by means of a pneumatic pestle. This method is very satisfactory for manganese, phosphorus and sulphur determinations. In the

case of a combustion carbon determination, it is necessary to kill the steel sample with aluminum in the sampling spoon. After the bath becomes soft, the plate sample is no longer used and the standard test sample must be employed till the heat is tapped.

Sulphur is generally considered the most difficult element of the common impurities to remove in the basic openhearth charge. In the experimental furnace, however, about 50 pct of the original sulphur content of the raw materials is removed. The average sulphur content of the metallic charge is about 0.03 pct while the sulphur in the finished steel is approximately 0.015 pct. This sulphur reduction is partly due to the favorable slag condition and the fact that the fuel used for firing the furnace is natural gas, which is quite low in sulphur.

Finishing, Deoxidizing Practices

The finishing and deoxidizing practices of this furnace have been, in general, similar to those employed in the regular mill furnaces. Ferrosilicon (silicon pig iron) of approximately 11 pct Si is generally used for deoxidation of the bath in the experimental furnace. The weight of this deoxidizer applied to the bath, ranges from 50 lb to 85 lb depending upon the size of the charge and the carbon content of the bath at the time the deoxidizer is added. Ferrosilicon of 11 pct Si is not an ideal deoxidizer for large openhearth furnaces, because the deoxidation products are not sufficiently fluid to coalesce into larger drops and ascend to the slag, consequently a finished steel with numerous non-metallic inclusions is obtained. In the experimental furnace with its shallow bath and relatively high temperature, the ferrosilicon has proved quite satisfactory as a deoxidizer.

If the particle size of the deoxidizer is too small, it is trapped in the slag, thus reducing the P_2O_5 in the slag and causing the phosphorus to revert back into the bath. To prevent this, all furnace additions are preferably of a size large enough to penetrate the slag and enter the metal bath. It is also advisable to moisten the surface of the additions before charging. As soon as the moistened additions strike the hot slag, a slight explosion occurs, caused by the sudden generation of steam. This explosion separates the slag and allows the additions to drop into the bath without being trapped in the slag. Before charging the ferrosilicon, about 30 lb of burnt lime are shoveled into the furnace in order to thicken the slag and to increase the free CaO, thus minimizing the phosphorus reversion. Five minutes after the final additions have been made the heat is ready to be tapped.

For the production of rimming steels, a regular mill furnace practice is employed. When the slag composition has reached the desired consistency and the elements present in the metal are within the desired specifications, the heat is tapped.

Addition of Alloying Materials

Manganese: The addition of manganese to the experimental heats is made in either the bath or the ladle. When amounts greater than 60 lb are required, the ferromanganese is added to the bath (lumps of 3 in. to 4 in. in size are preferable). This assures a thorough distribution of the element in the metal. For amounts less than 60 lb, particles of ferromanganese about ¾ in. in size, placed in paper bags of 5 lb each are added to the ladle.

Carbon: As stated previously, the practice followed in the experimental openhearth is to catch the carbon on the way down. At times the carbon drops below that desired and it is therefore necessary to recarburize the heat. Since experimental heats cannot be recarburized by "jiggering" to any great extent, the analyses is adjusted when necessary by coal additions to the ladle. These additions enter the metal at approximately 50 pct efficiency in terms of pure carbon. The carbon recovery from other carbon bearing additions, such as ferromanganese and Chrom-X, is in the neighborhood of 95 pct.

Silicon: Silicon is added to the ladle as a deoxidizer for killed steels and to meet chemical specification. Ferrosilicon of 50 pct and 90 pct Si and Alsifer, containing about 44 pct Si, are two of the most common deoxidizers used in the ladle.

Molybdenum: Molybdenum is introduced into the metal bath in powdered form known as molybdenum trioxide (MoO_3), containing 60 pct molybdenum by weight. Approximately 95 pct of the weight of the molybdenum addition enters the molten metal. The molybdenum containers are charged directly into the bath and worked under the surface. For heats finishing at 0.04 pct to 0.15 pct carbon the molybdenum is added when the carbon drops to about 0.25 pct. For high-carbon steels, the molybdenum is added when the carbon content is about 30 points above the blocking point.

Aluminum; For the manufacturing of fine grained steel, shot aluminum is added to the ladle, and the amount added depends upon the percentage of silicon and manganese per ton of steel and the final carbon content. Usually the amount varies from 0.8 lb to 1.3 lb per ton of steel.

Alnico Horseshoe Magnet Locates Casting Flaws

A NEW use for Alnico horseshoe magnets is reported by the Dings Magnetic Separator Co., Milwaukee 7. Formerly used by prospectors and in laboratory work, it is now being employed with finely divided magnetic sprinklings to inspect castings and welds for flaws.

The small but powerful horseshoe magnet is placed on the underside of the surface being inspected, and the magnetic sprinklings are spread on the upper surface. Operating on the principle that magnetic flux always seeks an edge, the sprinklings are induced by the magnet to collect at any minute internal or external cracks, if they exist, and to show up clearly as a line of powder.

This method of inspection is used where certain critical areas are known to develop cracks often, or for exploring surfaces of all castings. Both castings and welds can be inspected where the thickness of metals is as much as 1 in. The Alnico horseshoe magnet is 2½ in. wide and 3 in. high. Pole bases are ¾ x ¾ in.

Foreign Tool Steel Comparison Chart

THIS chart has been prepared to assist those called upon to identify foreign tool steels from the trade name alone. It is particularly timely now that so many inquiries are coming from users in Latin America who have been cut off from normal European sources of supply. This chart of foreign steels effectively complements the Chart of Comparable American Tool steels, which appeared in revised form in THE IRON AGE, Feb. 1, 1945, and the Directory of 1500 Tool Steels published by THE IRON AGE in booklet form.

THE data in this chart are in such a form as to be both convenient and informative, and the analyses designations serve to identify the grades of steel involved. All the data and the work involved in correlation have been carried out by engineers of A. Milne & Co., New York, and is the copyrighted property of that company. Upon written request additional copies of the chart are available to readers of THE IRON AGE. Any additions, suggestions, or criticisms are particularly welcome in order to increase the usefulness of future reprints.

Part One

Color of Bars Color de las Barras Cor das Barras Couleur des Barres	Analyses Analisis Analisis Analyses	Edgar Allen	Balfour	Wm. Jessop & Sons	Kayser Ellison	Samuel Osborn	Sanderson Bros. & Newbould	Wardlow's Ltd.	Canadian Atlas, Ltd.	Boehler	Poldi	Roechling
1—High Speed Steels—Aceros Rapidos, Acos Rapidos, Aciers Rapides												
Amarillo y Plateado Amarelo e Prateado Jaune et Argenté	18 W 9 Co 1 Mo 4 Cr 2 V		Ultra Capital Plus 2			Sobu Alloy	Tenco		Nipigon		MK Special	Gigant 10
Amarillo Amarelo Jaune	18 W 5 Co 4 Cr 1.30 V	Imperial Extra Special	Ultra Capital Plus 1	Ark Superiative			Kerau Wunda	Super Terrific		Super Rapid Extra 500	MK	Gigant 5
Plateado Prateado Argenté	19 W 4 Cr 2.25 V			Ark Superior	Kelloch 788	Triple Mushet	Saben Kerau		Trojan LXX Hil	Extra 214	Maximum Special	RSZ Especial
Azul Oscuro Azul Escuro Bleu Foncé	18 W 4 Cr 1 V	Imperial Special	Ultra Capital	Ark	Ke 881	Double Mushet	Saben Extra	Terrific	LXX Spartan-7		Maximum	RSZ
Azul Claro y Oscuro Azul Claro e Escuro Bleu Clair et Foncé	5.5 W 4 Mo 4 Cr 1.50 V	Stagmo		Moly Ark			Sub 66	W 6 & 4				
Rojo Oscuro Vermelho Escuro Rouge Foncé	9.50 W 2.50 Cr 0.10 to 0.15 V	#5 Hot Die	227 Tungsten Special Hot Die	B. B.		Tropic	Sanbron Hot Die	Double You Hot Stuff	Atlas Hot Die	Boehler #3 WKZ	212	RCW 2
2—Alloy Steels—Aceros de Aleacion, Acos de Liga, Aciers D'Alliage												
Ninguno Nenhum Aucun	1.3 C 4.5 W	Imperial Turning & Finishing	D.S.W. T.S.S	Alloy B				WFF			000 Extra R	T 76
Morado Purpura Pourpre	2.25 C 13.00 Cr	66	0.0.	Alloy C	Ke 970	N.A.D.	#476 Special	Double You Chrome	"NN"	"K"	2002 Special	RCC
Gris Cinzento Gris	1.55 C 11.50 Cr 0.75 Mo		S.C. 13		Ke 970	N.A.D.	#476	WHP	"FNS"	Special K	2002	RCC
Rosado Encarnado Rose	0.95 C 1.25 Mn 0.50 Cr 0.50 W	K-9	R.S.D N.S.S.3 R 9030	Superior Oil Hardening	Ke 798	Non-Shrink	Pitho	WNS	Keewatin	Amutit	Stabil	RUS

Ninguno Nenhum Aucun	0.90 C 3.75 Cr	#4 Hot Die		88 Hot Die				Double You Die			OO	
Marfil Marfin Ivoire	0.50 C 1.50 Cr 2.25 W 0.25 V	Minerva Special	Double Griffin Super Tool	J-4	Ke 960	C P 1	Pax Non Break	UUT	Falcon 4	Boehler #4 Star ETD	Tenax N	RTW 2 Robust
Cobre Cobre Cuivre	Aleacion Especial Liga Especial Alliage Speciale		Double Griffin Super Chisel							MY Extra		
Castano Castanho Marron	0.50 C 0.70 Mn 1.8 to 2.0 Si 0.25 Mo								Monark-2	MY No. 3	ESL	
Violeta Violeta Violet	0.60 C 1.00 Cr 0.20 V 0.55 Mn	Special Chrome Vanadium									CV	RTC 20
Ninguno Nenhum Aucun	0.90 C 0.10 to 0.20 V		S.C.P.					WSV		Boehler #16		

3—Carbon Steels—Aceros al Carbono, Acos ao Carbono, Aciers au Carbone

Naranja Laranja Orange	Especial Especial Special	Class E	Warranted Cast Steel	Warranted Best		Bow & Arrow	Independence Sanderson Special		Atlas Double Extra		EZH 2	RT 12
Rojo Vermelho Rouge	1.05 to 1.15 C	Stag	Warranted Cast Steel	Yellow Label Etiqueta Amarilla	Yellow End	Titanic	Extra Cast	Tough One	Atlas Extra XX95		EZH 2	RT 11 Marathon SS4
Blanco Branco Blanc	0.90 to 1.00 C	Talon	Red, White & Blue Colorado, Blanco y Azul	Leonard	Blue Seal		Colorado Water Hardening	Tough Two	Atlas Refined Tool	Alpine EZH Extra Tenaz Duro	EZH	RT 9 Marathon SS4
Verde Verde Vert	0.70 to 0.80 C	£. s. d.	Blue Label Etiqueta Azul				Loxley	Tough Three	Atlas Alpha			RT 6

Part Two Foreign Steel Comparison Chart

Color of Bars Color de las Barras Cor das Barras Couleur des Barres	Analyses Analisis Analisis Analyses	Schoeller-Bleckman (Phoenix)	Styria (Steierische Gussstahlwerke)	Deutsche Edelstahlwerke (Marathon)	Krupp	Aubert & Duval	Champagnolle	Chatillon-Commentry	Imphy	Longwy	Saut-du-Tarn	Schneider	Ugine
1—High Speed Steels—Aceros Rapidos, Acos Rapidos, Aciers Rapides													
Amarillo y Plateado Amarelo e Prateado Jaune et Argenté	18 W 9 Co 1 Mo 4 Cr 2 V	Hansa Especial K 10	Panther Special "779"	Kobalt Spezial	DFM Extra Especial	Extra J		5820		Double Géant		S.S. 8	
Amarillo Amarelo Jaune	18 W 5 Co 4 Cr 1.30 V	Hansa Especial K 5	Mammut★★	Kobalt I, II, or III	DFM ◆◆	Extra F	Chamax O	5815	Imphy Triple Rapide	Géant 3	S.D.T.-T.C.O.	S.S. 4	RSO
Plateado Prateado Argenté	19 W 4 Cr 2.25 V	Hansa Especial T 17 Extra	Rapid Panther Rapid Extra	000 Extra Rapid Spezial	DFM ◆	Rapide L		5755	Imphy Rapide Ultra			S. 3 V.	RSS
Azul Oscuro Azul Escuro Bleu Fonce	18 W 4 Cr 1 V	Pluto G	Mammut Mammut Special	Cardinal Rapid	DFMC	Extra B	Extra	W18		R.S.V.	Sans Rival Saint Juéry Extra	S. 3	MARS Supérieur
Azul Claro y Oscuro Azul Claro e Escuro Bleu Clair et Foncé	5.5 W 4 Mo 4 Cr 1.50 V												
Rojo Oscuro Vermelho Escuro Rouge Foncé	9.50 W 2.50 Cr 0.10 to 0.15 V	SGH SG	EWP	WC-2 DMS	DF-109-CN	Volvic		5655 5650 5654	I. W. 2	R.C.W. 2 R.C.W. 2Va R.C.W.M.	Victorieux Saint Juéry	S. 1. S.B. (7) S. 1. S.B. (7)-S.I. S.I.S.	R.D.

(Continued on next page)

Foreign Tool Steel Comparison Chart Part II Continued

Color of Bars Color de las Barras Cor das Barras Couleur des Barres	Analyses Analisis Analisis Analyses	Schoeller-Bleckman (Phoenix)	Styria (Steierische Gussstahlwerke)	Deutsche Edelstahlwerke (Marathon)	Krupp	Aubert & Duval	Champagnolle	Chatillon-Commentry	Imphy	Longwy	Saut-du-Tarn	Schneider	Ugine
2—Alloy Steels—Aceros de Aleacion, Acos de Liga, Aciers D'Alliage													
Ninguno Nenhum Aucun	1.3 C 4.5 W	Diamant Extra Duro	Diamant Diamant Special			SF 1	T 3 T 5	TSM No. 2	Imphy Tungsténe	R.T.W. 3		P 2	D.S.-TF
Morado Purpura Pourpre	2.25 C 13.00 Cr	Triunfador	Chrom Special Extra	Goliath Spezial	F-2048	Sancy	Cred	MF No. 1	CCR	R.C.C.h.	Talabot F.C. 2	13 FF (11)	K 12
Gris Cinzento Gris	1.55 C 11.50 Cr 0.75 Mo	Triunfador Z	Chrom Special	Goliath	DF-108C								
Rosado Encarnado Rose	0.95 C 1.25 Mn 0.50 Cr 0.50 W	Favorito SC1	Constant Special Constant	CRM Veresta Spezial	BFG		TSR	5250		R.U.S.	Talabot Special OM	CMP (3)	Sphynx
Ninguno Nenhum Aucun	0.90 C 3.75 Cr		Tenit 1720										
Marfil Marfin Ivoire	0.50 C 1.50 Cr 2.25 W 0.25 V	Tirano Extra	Tenit KL Tenit W	Durax W-3 Durax Spezial	BDFD	SF2	T 1	5630	I.W. 1	R.T.W. 2	Talabot A.C.T. No.1 Talabot A.C.T. No. 2	F.P.B. F.P.	KT
Cobre Cobre Cuivre	Aleacion Especial Liga Especial Alliage Speciale			CS	BDF 50G								
Castano Castanho Marron	0.50 C 0.70 Mn 1.8 to 2.0 Si 0.25 Mo	Tirano Prima						MN. SI		R.F.F.	Talabot MN.S	M.L. M.L.S. (3)	
Violeta Violeta Violet	0.60 C 1.00 Cr 0.20 V 0.55 Mn												
Ninguno Nenhum Aucun	0.90 C 0.10 to 0.20 Va		SFS										
3—Carbon Steels—Aceros al Carbono, Acos de Carbono, Aciers au Carbone													
Naranja Laranja Orange	Especial Especial Special	Extra Duro MX 4	P 2	Extra-Extra	HM 1&2	DU-MUV	C 12	Tenaille No. 2½	Helbimphy 12	R.T. 10	No.1	C. 1	E 1
Rojo Vermelho Rouge	1.05 to 1.15 C	Extra SO	P 3	SS 1 to 6	HM 3&4	MU	C 10	Chévre No. 2½	Helbimphy 9 Helbimphy 10	R.T. 9/10	No. 2	C.2—C.2B	2
Blanco Branco Blanc	0.90 to 1.00 C	Extra Tenaz Duro	P 4	SS 1 to 6	BS 1&2	AU	C 9	Chévre No. 3	Helbimphy 8	R.T. 8	No.3 Mine Talabot Special D	C. 4	3—E3
Verde Verde Vert	0.70 to 0.80 C	Mayor	P 5 P 6	SS 1 to 6	BS 3&4	U 6 U 7	C 7 C 8	Bélier No. 4	Helbimphy 7 Helbimphy 6	R.T. 7 R.T. 6	No. 6 Mine Tulipe Special D Mine Talabot Special	C. 5 C.6—C.6S	4—E4 5—E5

Precision Founding

. . . In this fourth of a series of articles on precision founding, the author discusses the making of plaster-base investment molds. With the use of auxiliary examples he shows how skillful employment of concealed venting and "cradles" make for the reduction of gas pressures on the mold walls.

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By FRANCIS DITTMAR
Consulting Engineer for Metal Products, Buffalo

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BEFORE proceeding with casting the 3-in. ring discussed in previous articles of this series, it may be advantageous first to consider the aluminum casting mentioned in Part III—an arch of 180° and 18 in. radius, with a 4-in. cross-section of half-round shape, see fig. 11. Problems of a similar nature would be everyday jobbing foundry propositions and the methods applicable in casting this arch have a wide range, as in connection with concealed venting, on the 3-in ring.

In regard to such venting, even if fluid metals were inherently free from gases, there would still be the air content of the mold and its cavity to consider, and also whatever gas may develop when hot metal strikes the mold. Consequently molds for castings of any size would have to be able to "breathe" so that these suddenly generated gases may escape. Such an escape cannot be effected with sufficient rapidity through the thick walls of the mold to insure sound castings. All that can reasonably be expected of a plaster-base mold is that gases become absorbed by its mass. This capacity of absorption, the penetrative range being limited, causes gases to back up and thus either tend to crack the mold or to result in distortions, in blowholes, sponginess, and the like. Because of the somewhat fragile nature of the molds these must have a certain massiveness and this militates against their efficiency. In order to eliminate this objectionable factor, extraneous venting is provided. Venting is further facilitated by encasing the mold in a highly porous form called a "cradle." A cradle permits gases inside a mold of comparatively thin wall to escape under moderate pressures and after their escape to exhaust themselves in unimpeded passage through the cradle. Moreover, a cradle supports the mold and reduces tendencies to distortion due to centrifugal pressures, thus permitting larger and fewer gates, and, as already pointed out, the making of heavier castings. The making and use of such cradles will presently be discussed in detail.

Meanwhile, aluminum being a lightweight metal having no particular gas emanations when fluid and further, the mold into which the arch is to be poured being a stationary one for gravity flow, there is no need of a cradle. On the other hand, because the skin of the casting is to be exceptionally smooth and free from blemishes the gates must be small and there can be no vent risers. (Incidentally, aluminum castings made in "permanent" steel molds have such vent risers and their skin is not as smooth as that of a casting poured in a plaster-base mold.) In order to avoid traces of vents on the casting, concealed venting is to be used in this instance. With this in view it would be advisable at this stage to trace with a pencil the outline of the pattern on a piece of plywood which should conform to the shape of the outside of the flask containing the mold. See fig. 12.

Stationary Mold

A steel cope-and-drag flask of about 42 x 22 x 6 in. would answer the present purpose. Clean the modelling board and give it a thin coating of any kind of lubricating oil. Then spread over it a sheet of newspaper big enough to cover the area of the flask. Put this sheet down carefully so as to avoid airpockets and wrinkles; it is to serve as an easy-parting intermediary. Upon this paper put the pattern, flat side down. It may be noted that there are at this stage no gates on this pattern. These are to be in the cope, as will be explained below. After giving the pattern a coating of parting compound of the kerosene-and-soap variety described in Part III, put the drag in place over the pattern, taking reasonable care that it is in the center of the drag. Then run a strip of clay or plasticine along the edge of the drag where it rests on the modelling board so as to prevent leakage of the fluid investment.

Into the pattern outline traced on the piece of plywood drive long, thin finishing nails—or lengths of No. 14 gage wire—so that these cover the entire area of the pattern and are to the number of about one to every square inch. These nails, or wires, are to project 2⅞ in. and should be cut off squarely at their points in order to give a flat maximum area each. When this is done put a couple of handles on the back of the plate so that it can be lifted without binding, for the entire plate with its projecting wires is to be pushed into the still wet, 3-in. thick investment in the cope so deeply that the ends of the wires stop ⅛ in. short of the mold cavity. It can readily be seen that all these small holes located in that part of the cope investment lying directly over the mold cavity, but not penetrating into it, form a series of small-diameter thin walls through which gases can escape without undue pres-

sure. This being a gravity-flow mold a further row of such vent wires may be inserted in the plywood board so that this row extends about ⅜ in. beyond and all around the outline of the pattern. (See fig. 13).

Molds With Asbestos

The investment in this case is a compound of plaster and a special grade of asbestos fiber called Mouldene—manufactured by International Talc Co. of Gouverneur, N. Y. These two ingredients should be mixed dry in a tumbling barrel so that every fiber of the asbestos is thoroughly coated with plaster. To do such mixing in a tub or, worse still, in a bucket by hand, or in some other slipshod and hurried fashion is to invite bad castings. It is to be borne in mind that it is the asbestos and not the plaster which forms the mold, the plaster serving merely as a binding agent. Therefore, the more thoroughly each single asbestos fiber is covered with the bond, while still dry, the more solid and homogeneous will the mold be. Tumbling is the only way in which such thorough covering can be achieved.

The proportions of Mouldene to plaster should be reasonably accurate and since these proportions will hereafter be expressed in percentages both the weight and the dry-measure of each is here given:

One qt of Mouldene weighs 9.1 oz

One qt of Moulding Hydrocal weighs 4 lb

Weighing the materials is the more accurate method of proportioning, but should it be necessary to measure them, the Mouldene and plaster must be measured in their loose form and not be packed down by jarring the measuring vessels.

The proportions of Mouldene and plaster vary with different casting propositions, depending on size, shape, alloys, etc. For instance, in the case of the 3-in. ring an 80-20 mixture would be used that is 80 pct Mouldene, 20 pct plaster, while for the aluminum arch the mixture would be 65-35. This is because the mold for the ring is comparatively small and compact while that of the aluminum arch is much larger and could not, because of economy, be made overly massive. Note that the depth of the drag which contains the mold is only 3 in. while the pattern cross-section is 2 in. thick. There is also the size of the flask which ought to be kept as small as is practicable. Hence a greater plaster content will be necessary in order to impart strength to the mold.

Tumbling speeds are around 25 rpm to 30 rpm and time allowance for thorough mixing is about 1 hr per cu ft of material.

The Mouldene-plaster-water ratio is also a variable one, depending on the quantity of plaster used. The less Mouldene and, therefore, the more plaster there is in this mixture, the more water will be needed to render a ready-flowing investment. The following data, while not absolutely accurate, will nevertheless serve as a practical basis for Mouldene-plaster-water calculations. Water taken at

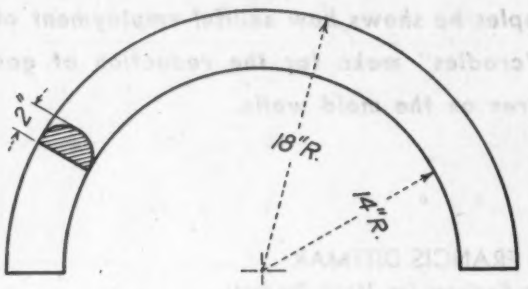


FIG. 11—The casting of this half-round arch in aluminum is used to analyze methods of concealed venting. All dimensions ± 1/64 in.

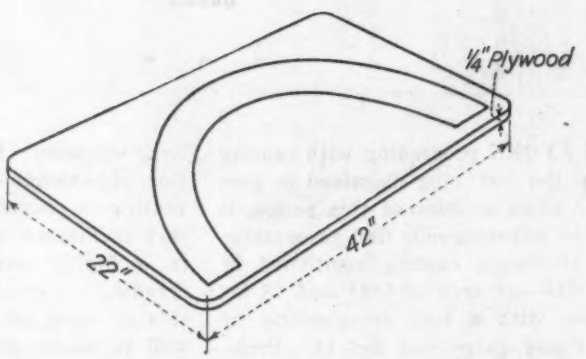


FIG. 12—An outline of the half-round arch (fig. 11) is first made on a piece of plywood for purpose of locating wires for gates.

2 lb per qt, Mouldene at 9 oz, and plaster at 4 lb per qt.

Since a quart of 50-50 Mouldene-plaster weighs 2 lb 4.5 oz and requires 1 qt or 2 lb of water, then a quart of 65-35 Mouldene-plaster weighing 2 lb 1.2 oz requires 1⅞ lb of water.

Distilled Water Used

Water used in making molds for precision castings should be distilled, especially in localities where the iron or sulphur content of water is exceptionally high or where other impurities in water are prevalent. This rule holds particularly for mass production of such castings where there are enough variables to contend with without introducing easily avoidable ones. Another consideration in favor of distilled water, as in cases where castings are to be of a rigidly specified metal, variations in analysis are often traceable to impurities in water used in making the investment molds.

With a properly tumbled mixture of Mouldene and plaster slowly sifted into the required quantity of water and, after waiting the necessary 4 min, the bucket containing the material is placed under the beater, of the kind shown on fig. 14. After 3 min of beating the investment is ladled into the drag until the pattern is covered with a thin layer; this first coating sparingly applied prevents air bubbles from forming. Gently jar the modelling board to shake the investment into place and after two or three further ladeled applications pour the rest of the investment into the drag, filling it flush with its rim.

In jobbing foundry practice it is always best to make up a little more investment than is strictly needed. For instance, the drag of the flask here used has a content of 1.6 cu ft, therefore, taking into the account pattern displacement, nearly 1½ cu ft of material, including water, should be used. This practice despite its appearance of waste will in the long run turn out to be a saving since it is cheaper to lose a little on inexpensive material than it is to make a new mold. Unfilled molds cannot very well be remedied with added investment because by the time another batch is mixed, the first pouring will have set and the two will not bond.

When the investment has set, roll the drag over and remove the paper separator. Give this investment surface a coat of shellac cut back 50 pct with alcohol. When the shellac is dry the entire surface is coated with parting compound.

Secure to the face of the drag, with a piece of plasticine, a stick of wood which is to support, temporarily, a 4-

in. diam sprue from which a number of ½-in. diam gates are to lead to the flat surface of the pattern (see fig. 15). Both the sprue and the gates are to be made of sticky wax (for venting) and where these gates join the pattern they should touch the pattern surface at right angles so as not to leave larger traces on the casting than are absolutely necessary. When all gates are in place, thus supporting the sprue, remove the wooden stick. Reinforce the soft wax with stiff wire

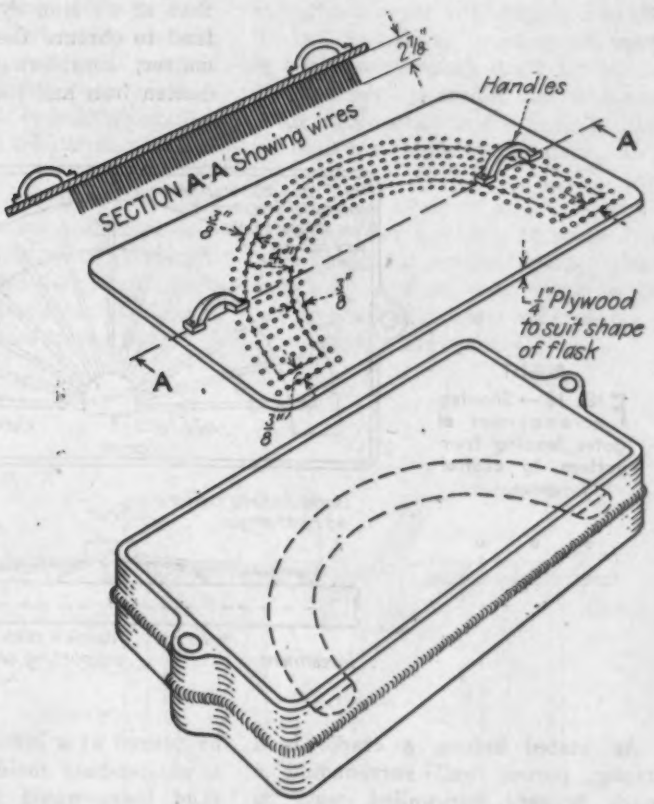


FIG. 13—The wires which are inserted in the plywood board are pushed into the still wet investment to provide holes through which gases can escape.

which can be drawn out of the mold after the wax has run out.

Then put the cope in place and seal its joint with the drag with clay or plasticine, and after the investment batch has been beaten, gently pour this into the cope, making sure no air pockets develop under the gates and at the bottom of the sprue. Fill the cope full of investment, even a little over, scraping off the surplus with a straight-edge of some sort just as the mass begins to set.

Then take the vent plate with its wires and press it into the investment to its full depth, immediately withdrawing it again. If the wires have been slightly oiled this would facilitate the operation. Should the wires also pierce the wax gates here and there it will not matter. The investment is by now sufficiently stiff to prevent distortion of the gates.

This having been done, lift off the cope and see that the gates on the underside show their full diameters. Remove the pattern and clean all clay from the cope-drag joint. The flask is now ready for baking.

Baking Practice

The baking can be done in a core oven capable of a temperature of from 450° to 500° F. Due to the quantity of water in the mold and also because of the wax gates and sprue, the baking should start slowly, at about 200° F. A low starting temperature allows the mold to warm up gradually with an equally gradual evaporation of water and a melting of the venting wax without burning it. The cope is placed separately in the oven, upside down so that the wax may run out and be gathered in a pan, after which it is joined to the drag again and the flask is baked as a unit in order to prevent warping.

Increase the oven temperature in slow stages. Maximum temperature should not exceed 750° F for this type of mold; 500° F will be enough and even 450° will do. At 500° F the time of baking is about 6 hr per in. of cross-section. Thus, in the present case, cope and drag being 6 in. thick, the time required would be 36 hr. At 450° F the time would be a little longer; at 750° less time is required; but not even in the case of the mold for the 3-in. ring need the baking temperature be in excess of 750° F.

After baking for the required length of time bring the oven temperature down gradually so that thermal shock on removing the flask for pouring is avoided. To check dryness of molds hold a mirror over the sprue; as long as a mist forms on the mirror the mold is incompletely dehydrated.

Do not pour molds below 300° F. Plaster has an intense affinity for atmospheric moisture and molds below 300° are apt to pick up this moisture and cause serious troubles.

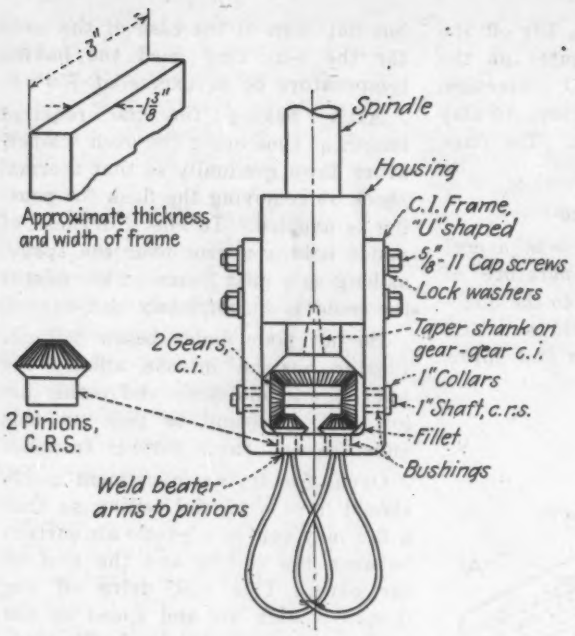
Ovens for drying investment molds should have a partial ceiling so that a fan may supply a gentle air current between the ceiling and the roof of the oven. This will drive off the moisture-laden air and speed up the drying process. Also a baffle-plate should lie between the flame or fire in the oven so that molds do not come in contact with concentrated heat. An inexpensive way of building such an oven will be described in Part VII of this series of articles.

Mold Shrinkages

The water content in investment mixing must be closely watched since water is the principal cause of mold shrinkages; the less water, the less shrinkage. Using the Mouldene-plaster-water proportions given previously will cause the mold to shrink 1 pct to 1.25 pct, the 0.25 pct difference depending on the speed and temperature with which the mold is baked. When using a baking heat higher than 500° F the shrinkage may be as high as 1.5 pct. For the half dozen aluminum castings under consideration, having a tolerance of ± 1/64 in., a satisfactory result will be obtained by adding the 1 pct or 1.25 pct mold shrinkage allowance on the pattern.

But if a greater number of castings were to be made of a greater accuracy it would be advisable to run a try-out mold through the oven in order to determine exact mold shrinkage before deciding on the precise dimensions of the pattern. In such a case the exact Mouldene-plaster-water proportions should be noted down so that these may be repeated with certainty and the mold should have, on its cope and on its drag face, some lines inscribed which are measured before placing the flask in the oven and again upon taking it out after its proper baking time.

Some sort of special platform upon which molds are to be poured should be erected. *Under no circumstances*

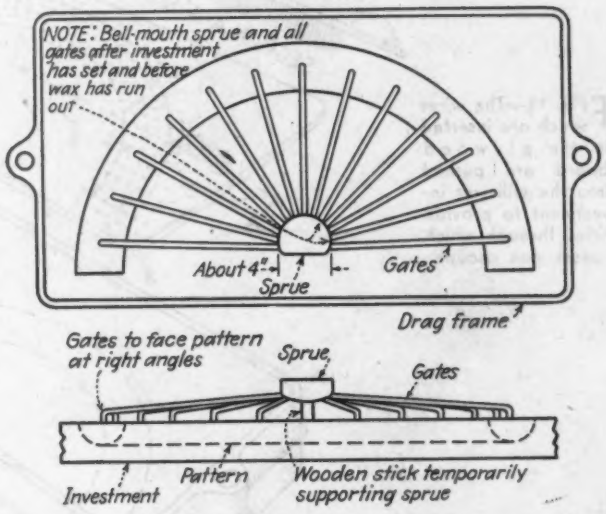


LEFT

FIG. 14—Details of heater used for making an investment of Mouldene, plaster, and water.

walled sand cylinder of 8 in. to 10 in. deep, the metal rising to the top of the mold by centrifugal force, and in this fashion, a predetermined quantity of iron having been poured into the mold, the casting would produce its own core.

Although this process of casting a cylinder is the most elementary of all centrifugal casting processes, it is chosen in order that the function of a cradle may be the more readily comprehended. Cradles are used on all sorts and shapes of castings if these are sufficiently large to warrant one. A more complicated example than that of an iron cylinder would only tend to obscure the issue. For that matter, considering the fluidity of molten iron and the fact that it can



RIGHT

FIG. 15—Showing arrangement of gates leading from pattern to central sprue.

attempt to pour plaster-base molds on a damp foundry floor. The pouring platform may be built of angle iron or wood, and it ought to be close to the oven since molds of this type must be poured while still hot. That the core ovens in a jobbing foundry are not usually located near the pit furnaces is unimportant because even if metal is chilled by carrying it some distance in the pouring ladle, the loss of heat incurred in pouring first from crucible to ladle and then during transit of the ladle to the mold is not great enough to make any difference. A dehydrated plaster-base mold has greater heat insulation value than does a sand mold and, consequently, lower pouring temperatures can be used. That insulation factor and the heat of the mold while pouring-off explains the small ½-in. diam gates on the aluminum casting.

The traces left by these ½-in. diam gates are readily obliterated with a file after the casting has been shaken out. In connection with anchoring the gates on the pattern prior to pouring the cope, this can be done with a small piece of clay or plasticine. The point is not to leave larger contact marks on the casting than can be removed so that the skin may present a uniform and unblemished surface.

Cradle Construction

In Part VII, when discussing the design and making of pouring funnels, the matter of cradles other than of core-sand will be gone into at this point, a description of their construction and application will be in order insofar as this would affect jobbing foundry practice.

As stated before, a cradle is a strong, porous wall surrounding a much denser, thin-walled mold in order to relieve gas pressures. In order to obtain the greatest possible porosity the sand used in making cradles should be free from dust and dirt, and one way of cleaning sand is to play an air hose on it while it is in a riddle.

As an example, consider an iron cylinder open at both ends to be cast centrifugally in a plaster-base mold. The reason for preferring this method over a gravity-flow sand casting process might be the necessity of obtaining a stronger, cleaner and denser metal, as would be desirable in piston rings. Another reason is that castings free from fused sand and hard scale are cheaper to machine.

However, in actual practice piston ring blanks would not be cast in a plaster-base mold when casting them centrifugally, there being no necessity for such a mold. The iron would be poured into a spinning flask containing a baked sand mold, a straight be poured at a lower temperature in a plaster-base mold than in one of sand there would be no difficulties about pouring this cast iron cylinder in a plaster-base mold.

The dimensions of this cylinder are given as 8 in. long, 6 in. OD, 5 in. ID, the cross-sectional wall being ½ in.

In order to illuminate the use of a cradle, the iron is to be poured in a plaster-base mold. Owing to the quantity of metal poured into this type of mold—a self-coring one, furthermore—there would be danger of distortion due to centrifugal pressures no matter how thick the mold walls were made. In fact, the thicker these would be the more give, or cushioning effect, would there be on the metal. Conversely, the thinner the mold walls, the more pressure-resisting will they be when surrounded by a rigid surface such as a cradle affords. Since the plaster-base mold is poured directly into the cradle which is already in the flask, the mold walls can be made as thin as practicable. For castings smaller than the cylinder

under discussion here, the walls would be as thin as ¼ in. or even less; in the present case ⅝ in.

Action of Gases

In fig. 16 it may be observed that gases set free in pouring can readily escape past the spout of the pouring funnel and also past the cover. But assuming that these passages were gas-tight and that there is no intervening porous wall between the mold and the flask, then gases would be arrested in the mold wall. Such penetration, while it takes place with great rapidity, nevertheless, does not travel very far; gases either strike the wall of the flask if the mold walls are thin or if these are thick they reach a point of saturation beyond which they cannot go without additional time and pressure.

The cushioning effect of the mold walls is simultaneous with the penetrative action of the gases. Both acting in unison cause distortion, cracking and in some cases gas pockets; in short, the result is a lost casting.

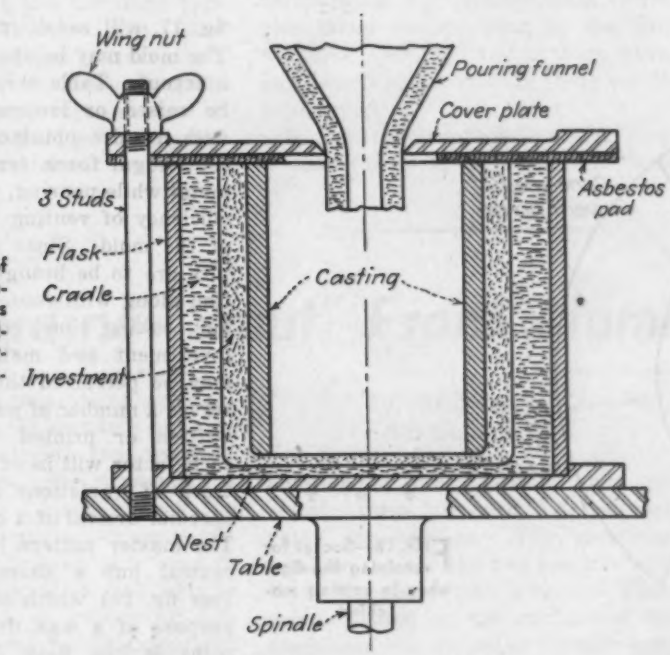


FIG. 16 — Use of the cradle to relieve gas pressures on mold walls is illustrated in the casting of an iron cylinder.

Since in the present case the mold wall is only ⅝ in. thick—just thick enough to give the mold the necessary strength—gases would penetrate this thickness and escape through the firm yet highly porous structure of the cradle. In cases where the cross-sectional wall of the casting is less than ½ in., or the casting itself is not of a self-coring type, a thinner mold wall can be used.

With comparatively thin mold walls concealed venting is inadvisable as this would weaken the wall and cause cave-ins due to centrifugal pressure. However, where the mold cavity lies in the drag of a flask or for that matter, partially also in the cope, and a cradle is used, then such venting should be introduced in the cope, thus doubly insuring a sound casting.

Cradles for jobbing foundry work are made of oil and sand of a mesh as coarse as can be obtained. The making and baking process is identical with that of the usual oil-sand cores. The inside faces of such cradles can have all the draft needed, but their outside faces should be straight in order to fit snugly into the flasks. In actual practice the core box is given enough draft to release the rammed-up cradle and whatever draft the outside walls have is filed off until the cradle fits the flask. In a jobbing foundry no hard and fast rule can be made to stick nor would it work. For instance, to make split core boxes for cradles so that these may have straight walls would be far too expensive in cases where only a few castings are wanted.

Sealing the Surfaces

Sealing the inner surfaces of cradles with a thin coating of warm stearin wax prevents the investment from clogging the open structure of the cradle and it also eliminates all danger of "killing" the plaster content by a too rapid water absorption. A further advantage is that the cradle is much more easily cleaned afterwards so that it may be used over again. For more permanent cradles see Part VII of this series of articles.

In mixing investments to be poured into cradles care should be taken both in regard to correct water allowances and in the baking of the mold. For, if too much water is used the mold may shrink away from the cradle walls and if the baking heat is applied unevenly the mold will expand quicker than the cradle and so will crack. This dictum will have to be adhered to along with what has been said previously about the use of a baffle plate over the fire. There must also be a gradual reduction of oven heat after proper length of baking time, and molds must not be poured under 300° F, above all not on a damp foundry floor. Owing to the virtually limitless varieties of casting propositions in this type of founding no positive, unbreakable rules can be given, aside from the ones called attention to in this work.

Try Castings

Having analyzed the function of cradles, using as an example, the casting of an iron cylinder, the 3-in. ring try patterns and their investment for the purpose of making try castings can now be discussed.

It will be noted in fig. 17 that the try pattern lies in a split flask. The reason for this is that in mass production, using wax patterns, these and their gates melt out of a one-piece or solid investment and, consequently, only a solid flask is needed. At present, using plaster patterns, these must be broken out of their investment. Hence, it would be impossible to get the gates out of a solid mold.

Use enough Mouldene-plaster compound of 80-20 density, that is, 80 pct Mouldene, 20 pct plaster, to do for one flask filling. Then put the drag part of the flask on a flat plate of clay and press it down a little so that there will be no leakage of investment. Next, mix enough water with some investment compound to fill the drag and pour this in. The moment it begins to set place the pattern in the drag, fairly centrally, so that the gates rest on the surface of the investment. (The pattern has, of course, previously been shellacked and coated with parting compound.) When the investment in the drag has set, give it a coating of parting compound.

Next place a piece of 1 in. brass tubing coated with parting compound on the ⅛-in. high part of the central hub lying above the gates, see fig. 17. This piece of tubing is later withdrawn and thus forms the sprue hole. Then put the cope in place and invest

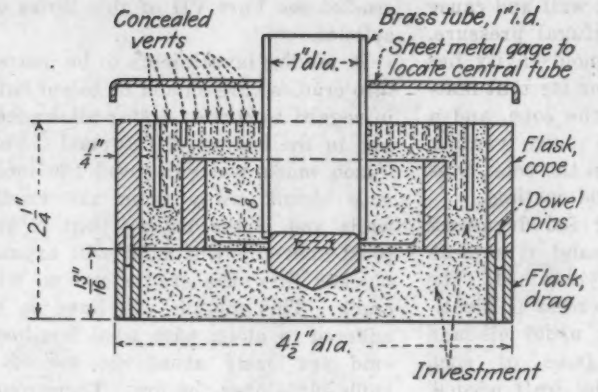


FIG. 17 — Mixture of 80 pct Mouldene to 20 pct plaster is used as the investment to insure round the plaster try patterns in a split flask. The brass tube is removed in order to form the sprue hole.

the rest of the pattern, gently jarring the modelling board to insure even settling. When the contents of the cope has set withdraw the brass tube and open the flask.

The try pattern will lie in the cope from which it must be removed in pieces. In order to save baking time the flask is not put together again until it is ready for pouring. In this case the baking time can be speeded up considerably since the mold is small and compact and even if small cracks should develop they will not interfere with checking. The main point to be arrived at now is metal shrinkage in relation to pattern size. However, other factors such as mold shrinkage, baking time, correct density of investment in relation to smoothness of skin—and so to accuracy—and venting should also be noted at the very first try casting made. In regard to venting, a wooden or metal disk with inserted wires of proper length might as well be made at this stage so that concealed venting and its effects may be observed from the start. See fig. 17. In ascertaining the complete dehydration of the mold after a first approximated period of baking time, hold a mirror over the sprue for a few seconds to observe collection of moisture.

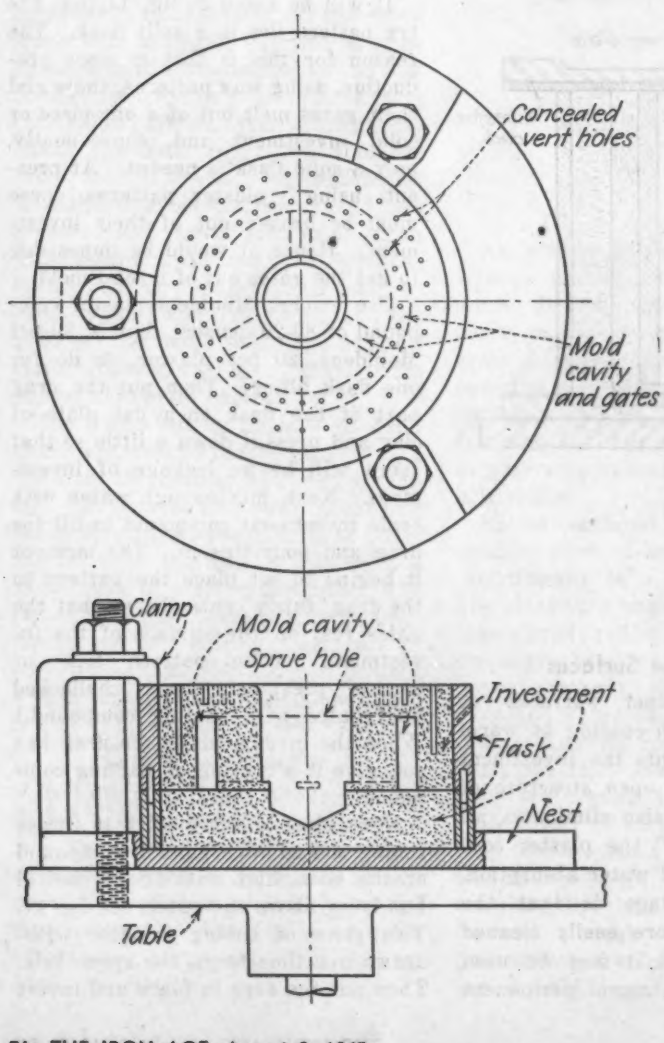


FIG. 18—Socket for retaining the flask when in casting machine.

Flask Socket

Fig. 18 shows a shallow nest or socket into which the flask is put to insure its running true on the casting machine table. This is not strictly necessary; molds for try patterns may be trued up any old way; but they must, however, be held down firmly with the clamps. Also, the sprue hole should be fairly concentric with the flask, and using a gage, as shown in fig. 17, will result in such alignment. The mold may be spun at 500 rpm for a tryout. Table speeds may have to be raised or lowered in accordance with results obtained, depending on centrifugal force, temperature of the metal while pouring, number of gates, efficiency of venting and temperature of the mold. Since all of these factors are to be brought into coordination along with those of mold shrinkage, baking time, correct density of investment and metal shrinkage, it may be perceived that a try pattern serves a number of purposes. A typewritten or printed form specifying each factor will be of help in keeping track of variations and also in the speedier arrival of a conclusive result. The master pattern has added to its central hub a short, tapered piece (see fig. 19) which serves the double purpose of a wax drain and a gage point in the flask determining the height of the pattern in the flask. Its central position is located by a gage similar to the one used in locating the tube on the try pattern. The ¼-in. hole left in the bottom of the mold by the wax drain is plugged with investment in a separate operation after all wax has left the mold and before the actual baking takes place. In connection with wax draining it may be pointed out that if the gates are on a slight angle, such as shown on fig. 19, draining is greatly facilitated. The gates can be given a slant by making them at the outset somewhat

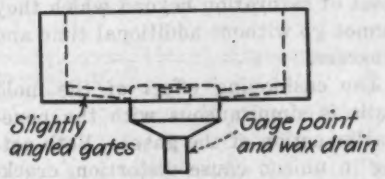


FIG. 19—The lower tapered piece acts as a wax drain as well as a gage for determining the height of the pattern in the flask.

thicker than necessary and cutting them to the desired angle on the try patterns.

Attention is also called to fig. 4, which shows the cylindrical part of the central hub to be ⅜-in. long minus the distance shortened by the 20° angle. The cylindrical part of the hub projects about ¼ in. below the gates; this leaves a depression in the mold which forms the bottom of the sprue hole. This depression is to receive the stream of molten metal when pouring and its surface is lower than that of the gates so that fragments of the mold, torn away by the force of the metal, will not enter the gates. The 20° angle is there to facilitate wax drainage.

In mass production there would, naturally, be no modelling board to jar to insure settling of investment; flasks would arrive at their filling station on a conveyor to which at this point is attached either an electric vibrator such as is made by Pressed Steel Co. of Muskegon, Mich., or a pneumatic one of the Branford type (New Haven Vibrator Co., New Haven). Dipping wax patterns in a 0.1 pct solution of Aerosol would further speed up the process, and so would the use of distilled water held at an even temperature. A more detailed discussion of such production setups will be gone into in Part VII.

Silex Molds

Silex is a trade name for ground silica (powdered quartz)—obtainable from the Ottawa Silica Co., Ottawa, Ill., and is used instead of asbestos fiber in plaster-base molds where delicate details and/or a very smooth skin is wanted. The quartz is ground to various degrees of fineness and is suitable in cases where metal to be cast is comparatively free from gases since a Silex-plaster mold is very much tighter in structure than is one leavened with asbestos. For instance, in the present case of a mold for the 3-in. ring to be cast in an alloy of 64 copper, 33 zinc and 3 lead, an asbestos-plaster mold would be preferable because of the quantity of gases set free in the pouring. Because of this an 80-20 compound was selected, high in Mouldene and with just enough plaster to form an effective bond. If the metal were bronze—85/5/5/5—a Silex-plaster mold would give better results—that is, the skin would be smoother and if there were any details on the casting these would be sharper.

A further advantage in using Silex is that the mold is more rigid than one containing asbestos and so has less cushioning effect on metal injected under centrifugal pressure; hence there would be less tendency of distortion. Like an asbestos compound, Silex also ought to be tumbled with plaster to produce an efficient mixture. But unlike asbestos fiber Silex has no water absorption factor at all and so the water content of a Silex mold is less than that of an asbestos one since all water in the mixture is free to react immediately upon the plaster. This makes for a stronger mold, less mold wall thickness and shorter baking time. The matter will again be referred to along with other refractory materials used in precision founding in Part IX.

The United States Gypsum Co. has on the market a ready prepared compound called Metal Casting Plaster. This material contains besides its bonding agent, plaster asbestos fiber and some other refractory substance. (See company bulletin IGL-22). This company is also putting on the market another casting compound at present called NFI, of which no details are available at this time of writing.

(In a following article next week the factor of shrinkage in the master pattern and its matrix will be discussed.)

Avoiding "Smut" From Aluminum Etchants

By FRED TAUBER
Independence, Mo.

FLUORIDE preparations are frequently used as etchants for aluminum sheets prior to spot welding, but in many cases after removing the oxide they leave a black film on the surface of the etched metal, commonly called "smut." Cleaning this smudge off is an extra operation that adds to the time and cost of processing. Recently it has been demonstrated that this smut may be "decoyed" from depositing on the product by taking advantage of a well known principle of electrochemistry involving the electromotive series of metals.

The etchant normally used is a water solution of an acid radical containing fluorine atoms which react similarly to those in hydrofluoric acid, but at a greatly reduced rate. The fluoride preparations etch the aluminum surface forming metallic fluorides and liberating hydrogen. Since commercial aluminum alloys may contain iron, manganese and copper in addition to other metals and nonmetals, these are also attacked and enter the solution. The aluminum tends to replace the less reactive metals in the electromotive series. These are deposited on the surface of the aluminum workpieces as metallic salts which have a high electrical resistance.

If the alloying metals are removed from the solution as they are dissolved, they will not deposit on the etched surface. This removal can be accomplished by the use of a metallic couple composed of aluminum in the form of scrap and a metal less reactive than any of the alloying metals, such as lead, which is quite low in the electromotive series. The aluminum scrap will go into solution, replacing the less reactive metals which will deposit upon the lead in a non-conducting layer. For this reason it is advisable to have as large a lead surface as possible, a goal which is most easily attained by using a lead-lined tank. The couple can be set up by simply dropping some flat pieces of aluminum scrap in the bottom of the tank.

When the lead lining of the tank has become well coated with a black film, the solution should be drained out and the film washed off. The lead is not affected by the etchant. Although the etchant can be replenished and brought up to its original strength, it is more economical to make up a new solution as the fluoride preparations are relatively inexpensive, besides being difficult to handle. Only a few pounds of aluminum scrap will be needed per week in the average sized tank. Thus the cost of preventing the smut is negligible and is more than offset by increased efficiency in the actual spot welding operation.

Creep Resistant Alloy Steels

Translated by T. COSMAN

. . . The behavior of alloy steels at prolonged elevated temperatures has been studied by S. E. Wolfson and M. P. Myahkov and reported in the Soviet journal, Stal, Nos. 3 to 4, 1943, pp. 42 to 47. These studies show that the addition of molybdenum to steel imparts high heat strength. Vanadium has a similar reaction in steel alloys but to a lesser degree. The comparative effect of other alloying agents like chromium, nickel, manganese and silicon on physical properties is also included in this article.

FOR successful service at elevated temperatures and high stresses, steels should meet the following qualifications, to a degree varying with service conditions and design.

(1) At ordinary temperatures stay bolt material should have a high yield limit and considerable strength.

(2) Toughness at higher temperatures should be adequate.

(3) General deformation during the initial creep should be at a minimum. The rate of the subsequent creep should be much smaller under higher stresses.

(4) Steel for stay bolts should not be subject to temper brittleness.

(5) Steel quality acquired by heat treatment should not be reduced in operation at higher temperatures.

In the petroleum industry and for boilers at temperatures below 707 deg. F. and at pressures lower than 20 atmospheres, carbon steels, ST4 and ST5 (see Table I for chemical analyses) have been used for stay bolts with considerable success. At higher temperatures or stresses, low alloy steels have been found to be superior.

Among the special steels for stay bolts, chromium-nickel steel containing 0.25 to 0.45 per cent C, 0.5 to 1.5 per cent Ni and 0.5 to 0.75 per cent Cr is very widely used.[1, 2] However, the application of this steel for bolts even at comparatively low temperatures (752 deg. F.) proved that it does not meet the necessary requirements. There were failures when the steel

[1] *Energeticheskoje obozreniye (Technique of Heat)*, 1933, *No. 7.*

[2] *Engineering*, 15, *XII*, 22, *XII*, 1935, 5/I *and* 19/I—*Survey.*

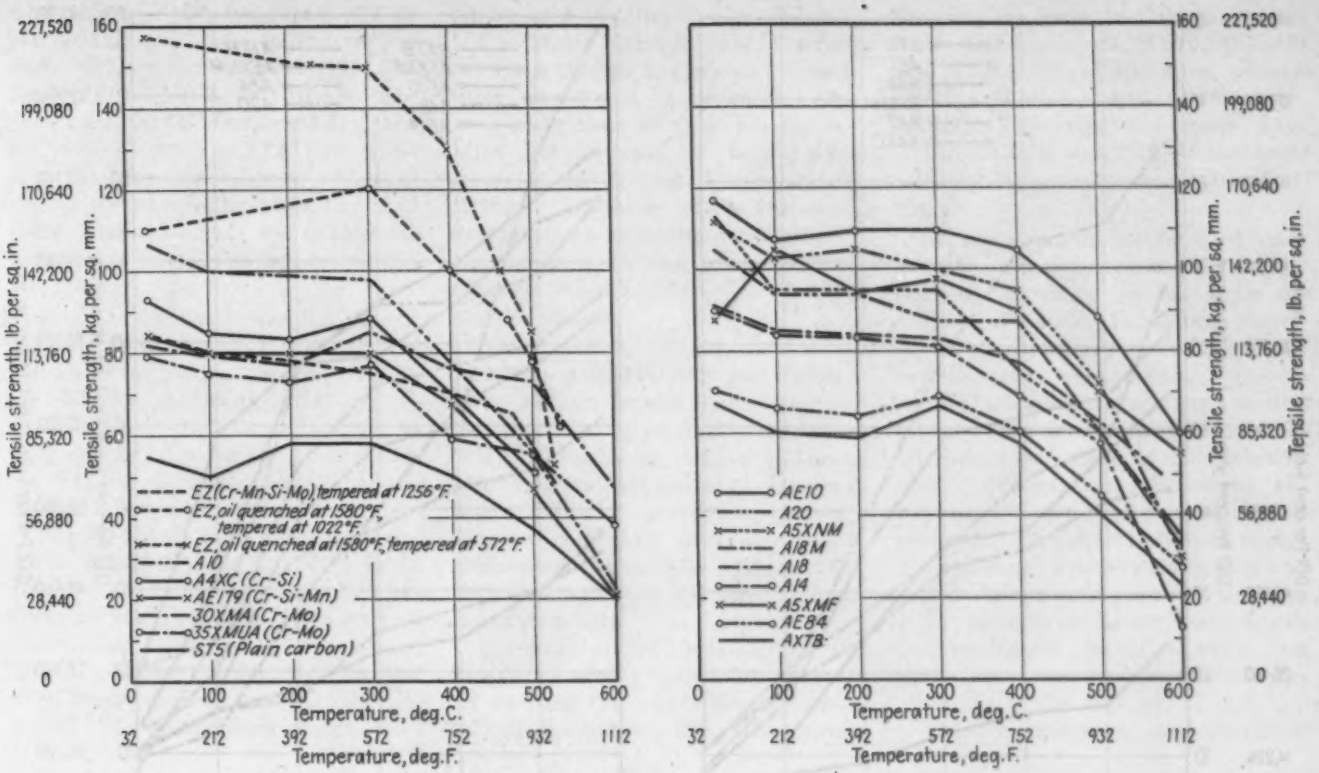
TABLE I

Chemical Composition and Mechanical Characteristics of Various Creep Resistant Steels

Steel	Symbol	Chemical Analysis, Per Cent								Heat Treatment	Tensile Strength lb./sq. in.	Yield Point lb./sq. in.	Elastic Limit (0.01%) lb./sq. in.	Elongation l=10d Per Cent	Reduction Area Per Cent	Brinell Hardness	Impact Strength Ft. lb./sq. in.
		C	Mn	Si	Ni	Cr	W	Mo	V								
Carbon	ST4	0.28	0.64	0.25	.....	.....	.....	.....	.....	As rolled	72,000	46,500	38,500	27.8	58.4	153	396
Carbon	ST5	0.36	0.53	0.19	.....	.....	.....	.....	.....	As rolled	77,000	46,500	35,000	24.8	52.4	156	298
C-Si	A4XC	0.36	.....	1.20	.....	1.30	.....	.....	.....	OQ/1620							
C-Si		0.45	0.40	1.60	.....	1.60	.....	.....	.....	T,OC/1020	133,000	117,500	112,000	12.7	57.6	240	364
Cr-Si-Mn	AE 179	0.32	1.08	1.04	0.21	0.93	.....	.....	.....	OQ/1620 T,AC/1110	121,500	102,000	88,000	14.8	65.9	231	438
Cr-Mn-Si-Mo	EZ	0.37	1.93	1.47	.....	.....	.....	0.35	.....	T,OC/1260	113,500	97,500	69,000	16.1	60.8	220	382
Cr-Mn-Si-Mo	EZ	0.37	1.93	1.47	.....	.....	.....	0.35	.....	OQ/1580 T/1020	156,000	140,000	100,000	9.8	48.6	300	233
Cr-Mn-Si-Mo	EZ	0.37	1.93	1.47	.....	.....	.....	.....	.....	OQ/1580 T/570	225,000,	192,000	116,000	5.8	48.1	380	91
Cr-Mo	30XMA	0.23	.....	.....	.....	0.93	.....	0.26	.....	OQ/1620 T,OC/1110	120,000	106,000	104,000	11.5	65.0	220	715
Cr-Mo	35XMUA	0.33	0.42	0.30	0.35	1.62	.....	0.58	*	AC/1740 T,FC/1200	113,000	90,000	86,000	15.0	64.2	230	793
Cr-Ni	A10	0.44	.....	.....	3.31	1.38	.....	.....	.....	OQ/1740 T,AC/1065	149,500	140,000	137,000	9.9	52.7	320	298
Cr-V	AXTB	0.44	0.59	0.36	0.34	0.88	.....	.....	0.20	OQ/1620 T,AC/1110	96,000	51,000	49,500	21.4	54.0	180	177
Cr-Mo-V	AE10	0.24	0.50	0.31	0.15	1.70	.....	0.25	0.30	OQ/1620 T,OC/1200	166,000	152,000	144,500	7.5	54.7	335	730
Cr-Mo-V	A5XMF	0.44	0.40	0.27	.....	1.40	.....	0.46	0.26	OQ/1620 T,OC/1200	126,000	114,000	113,000	10.5	62.7	830	564
Cr-Ni-W	A18	0.21	.....	.....	3.61	1.28	1.08	.....	.....	OQ/1560 T,OC/1070	129,500	110,500	107,000	18.6	68.0	290	681
Cr-Ni-V	A14	0.21	0.35	0.25	3.96	1.06	.....	.....	0.29	OQ/1560 T,OC/1080	127,000	105,000	93,000	14.7	63.6	248	247
Cr-Ni-Mo	A18M	0.22	0.34	0.37	4.27	1.51	.....	0.34	.....	OQ/1560 T,FC/1200	150,000	136,000	129,500	10.2	63.3	280	662
Cr-Ni-Mo	AE84	0.38	0.45	0.25	1.43	0.72	.....	0.22	.....	OQ/1560 T,AC/1070	101,000	53,000	51,500	17.0	39.1	194	189
Cr-Ni-Mo	A5XNM	0.65	.....	.....	1.59	0.71	.....	0.25	.....	OQ/1510 T,OC/1110	155,000	148,500	144,500	9.5	52.2	230	634
Cr-Ni-Mo	A20	0.42	0.37	0.30	4.33	0.70	.....	1.04	.....	OQ/1830 T,FC/375 T,OC/1160	158,500	85,500	49,500	9.2	33.2	.....	289

*1.21 A1

OQ = Oil Quench
T = Tempering
AC = Air Cool
OC = Oil Cool
FC = Furnace Cool



• • • Fig. 1—Tensile strength as a function of temperature.

was cold, and in order to assure reliable joints during working, strapping had to be resorted to frequently because connections loosened in time due to increased strain on the bolts.

Laboratory research showed that chromium-nickel steel has an even higher heat stability at 707 deg F.[3]

[3]*R. W. Bailey, G. H. Dickenson, N. P. Inglis and G. H. Pearson, Symposium on Effect of Temperature on the Properties of Metals*, 1931.

[4]*R. W. Bailey and A. M. Roberts, Engineering*, 1932, *No.* 3450.

than has carbon steel, but also that chromium-nickel steel has a higher temper brittleness than carbon steel.[4] Consequently there has been of late a tendency to use other steels for stay bolts, especially those containing molybdenum.

The two following chemical compositions are recommended for molybdenum steels: 0.4 to 0.5 per cent C, 1.0 to 1.5 per cent Cr, 0.4 to 0.6 per cent Mo and 0.28 to 0.35 per cent C, 2.3 to 2.8 per cent Ni, 0.5 to 0.7 per cent Cr, 0.6 to 0.8 per cent Mo. A steam power plant in Detroit[5] using

[5]*R. Tompson and R. Van Druzer, Transactions, ASTM*, 1934.

these steels found them to give very good service even at 1004 deg. F., but stresses, however, were not excessive.

For temperatures above 932 deg. F., it has been American practice to use steels with a higher heat stability than either the chromium-molybdenum or chromium-nickel-molybdenum, for example Steel A with 0.4 to 0.5 per cent C, 1.1 to 1.4 per cent Cr, 0.8 to 1.1 per cent W and 0.3 per cent V; Steel B, 0.35 per cent C, 0.52 per cent Cr and 0.94 per cent W, and Steel C, 0.4 to 0.5 per cent C, 1.25 per cent Cr, 2.0 per cent W and 0.25 per cent V. Steel A did not come up to all specifications, but better results were obtained with Steel B which required only one strapping per year, and the best results were achieved with Steel C.

The ASTM in 1937[6] specified the composition of stay bolt steel for service temperatures of 752 to 1112 deg. F., but in this standard the limits of temperature application were not defined, the specification including only the quenching temperature and corresponding necessary mechanical qualities on cooling.

[6]*Standard ASTM A193-37T, ASTM*, 1937, *Vol. I.*

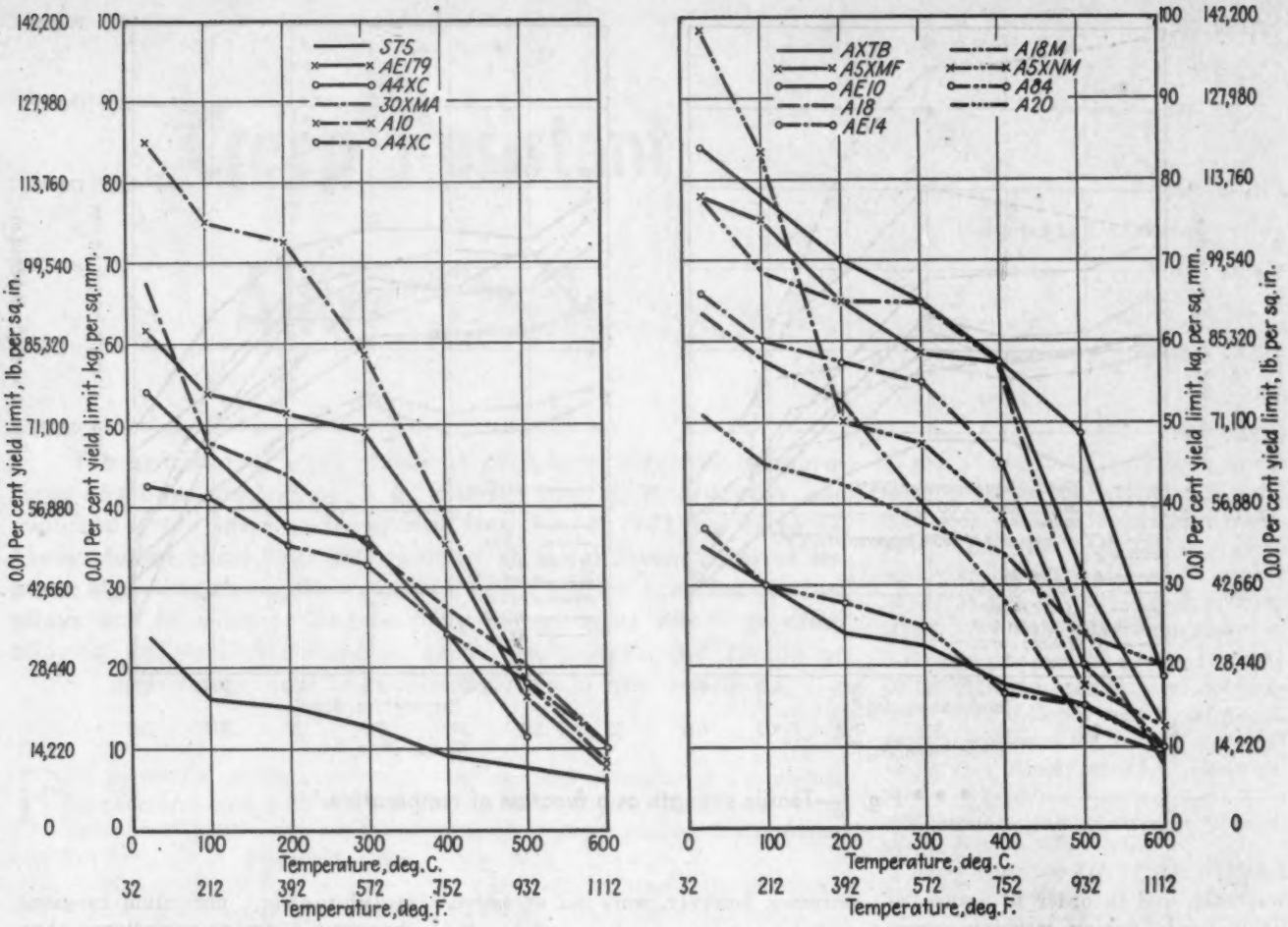
Creep resistance was the primary criterion in the selection of steels for a series of laboratory experiments. Carbon, chromium-nickel, chromium-molybdenum, chromium-tungsten, chromium-tungsten-vanadium, chromium-tungsten-molybdenum steels are generally used for joints that have to operate at elevated temperatures. Some of the above steels are closer to tool than to structural steel in their composition, Steel C, for example. Experiments, therefore, were not limited to structural steels only but also included tests on some of the standard tool steels in order to determine whether they could be applied successfully.

Since the material was to be used at high temperature, tempering was performed at correspondingly high temperatures, usually about 212 deg. F. higher than the working temperature. To a certain degree this guarantees the preservation of qualities imparted by heat treatment when working conditions expose the steel to considerable temperatures.

Table I shows the various steels used in the experiments, their chemical composition, heat treatment and mechanical qualities.

Strength at High Temperature

Steel ST5, a plain carbon steel, has the lowest tensile strength. Steel A4XC, a chromium-silicon alloy and steel AE179, a chromium-silicon-manganese steel, have high tensile strengths up to 842 deg. F. and then



• • • Fig. 2—0.01 per cent yield limit as a function of temperature.

suffer a sharp decline so that steel AE179 at 1112 deg. F. has almost the same tensile as the carbon steel ST5.

Chromium - molybdenum steel 30XMA and chromium - molybdenum-aluminum 35XMUA in the temperature range of 572 deg. to 842 deg. F. have a lower tensile strength than steels A4XC, AE179 and A10. However, at higher temperatures their tensile values are greater, that is, this latter group of steels has a higher heat strength. (See Fig. 1.)

Chromium-nickel steel A10 has a rather high tensile up to 752 deg. F. Beyond that temperature it decreases sharply approaching that of carbon steel at 1112 deg. F.

Chromium-vanadium steel AXTB has a low tensile strength throughout, while chromium - molybdenum - vanadium steels AE10 and A5XMF have high values up to 1112 deg. F.

An addition of 1.08 per cent tungsten to the chromium-nickel steel greatly increased the tensile strength in the temperature interval between 752 and 1112 deg. F. Thus, tungsten has a beneficial effect on the heat stability of chromium-nickel steel at higher temperatures.

Where 0.29 per cent vanadium is added to the chromium-nickel steel AE14, the strength of the steel is only slightly improved in the short-term test.

In the chromium-nickel steel, molybdenum increases the strength of the steel at higher temperatures, especially above 932 deg. F. With molybdenum (steel A20) the tensile strength increases over the temperature interval between 932 and 1112 deg. F.

The yield limits between 0.01 to 0.2 per cent (Figs. 2 and 3) characterize to some degree the deformation of the steel at higher temperatures. These limits, therefore, can be useful in the comparative appraisal of steels to be used under high stresses at high temperatures.

Steel ST5 has a somewhat lower yield limit in the temperature interval between 68 deg. and 932 deg. F.

TABLE II

Creepage of Steels at 890° F. and Stress of 17,000 lb. per sq. in.

Steel Desig.	ST5	AE179	30XMA	35XMUA	A10	AXTB	AE10	A5XMF	A18	A14	A18M	AE84	A5XNM	A20
% of permanent deformation after 200 hr. of work	0.8100	0.390	0.0170	0.0494	1.03	0.155	0.0098	0.0669	0.094	0.091	0.049	0.135	0.106	0.160
% of creepage rate on the sample from 100–200 hr.	83.10^{-5}	97.10^{-5}	5.10^{-5}	98.10^{-5}	225.10^{-5}	25.10^{-5}	7.10^{-5}	3.10^{-5}	30.10^{-5}	14.10^{-5}	20.10^{-5}	16.10^{-5}	17.10^{-5}	2.10^{-5}

At 1112 deg. F. the yield limit of 0.01 per cent is the same in the carbon steel ST5, in Cr-Ni steel A10 and Cr-Si-Mn steel AE179. In the temperature interval between 68 deg. and 932 deg. F. steels AXTB and AE84 also have low yield limits. At 1112 deg. F., however, the yield limits of these steels exceed the analogous limits of carbon steel approximately 1.7 times.

Steel AE10 has somewhat higher yield limits in all the temperature intervals so far studied. Steels A5XMF, A5XNM and A18M up to 932 deg. F. also have high yield limits but not as high as they are in the steel AE10. At 1112 deg. F. steel A5XMF has the highest yield limit.

Comparatively high yield limits are found in 30XMA and 35XMUA in all temperature intervals. Steel A20 has a rather low limit of 0.01 per cent up to 752 deg. F., high at 932 deg. F. and still higher at 1112 deg. F. The last fact shows once again that with increase of molybdenum there is a higher heat stability in alloyed steels.

The impact strength (Fig. 4) of all the steels studied at elevated temperatures was found to be rather high (not lower than 45 ft-lb. per sq. in.) With the increase of temperature from 572 to 752 deg. F. the impact strength of these steels increases, dropping to a minimum at 932 deg. F. and again increasing when the temperature rises further. Steel AE84 is an exception.

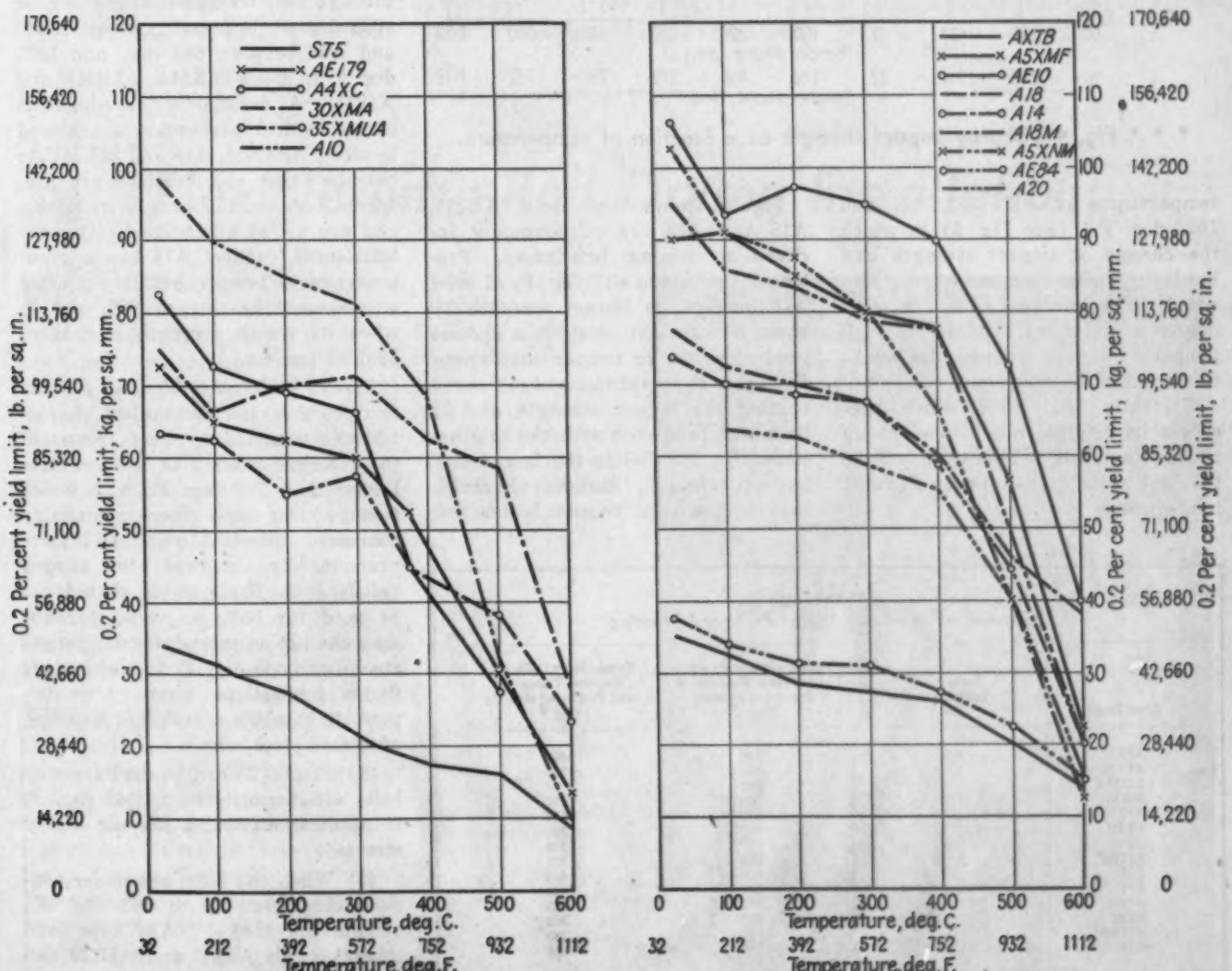
Steels AE10, A18M, 35XMUA, A5XNM, A5XMF, A18 and 30XMA have a high impact value at —51 deg. F. This is especially important where there is a danger of creep taking place at ordinary temperatures. Special precautions against extreme cold have to be observed in these cases. Steels A14, AE84, AXTB, A10 and A4XC do not have this important quality.

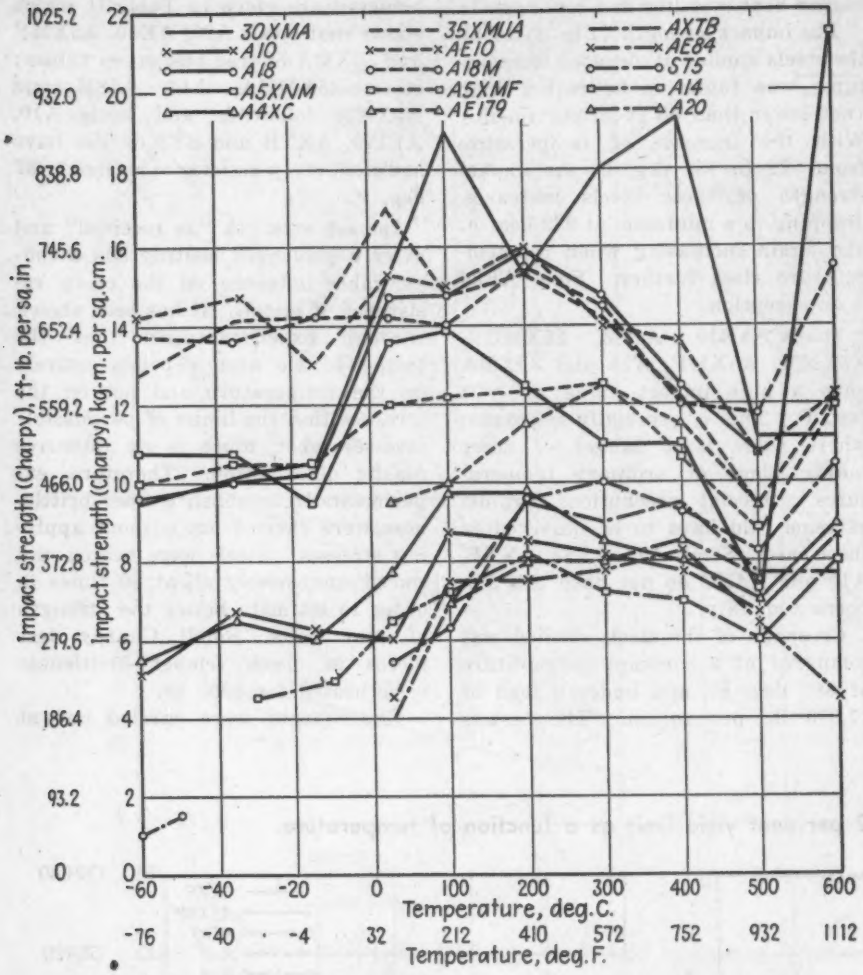
Creepage of the steels studied was compared at a constant temperature of 887 deg. F., and under a load of 17,000 lb. per sq. in. The results achieved are given in Table II which shows that steels A20, AE10, A5XMF and 30XMA offered best creep values; steels 35XMUA, A14, A18M and A5XNM following, and steels A10, AE179, AXTB and ST5 do not have sufficient creep resistance at about 887 deg. F.

Impact strength "as received" and after a prolonged heating has a considerable influence on the creep resistance of metals. It has been shown through experimentation that the temper-brittle area depends entirely on the temperature and not on the stress within the limits of permissible stresses when there is no intensive plastic deformation. Therefore, experiments to establish temper brittleness were carried out without applying stresses. Steels were heated and cooled successively about 80 times in order to estimate better the strength of stay bolts. Small Charpy test pieces to check temper brittleness were heated for 1000 hr.

Experiments were carried out at

• • • Fig. 3—0.2 per cent yield limit as a function of temperature.





• • • Fig. 4—Charpy impact strength as a function of temperature.

temperatures of 617, 752, 887 and 1022 deg. F. (See Fig. 5) in which the change of impact strength and hardening after treatment was also noted. The hardness shows to what degree a prolonged exposure to high temperatures can change the qualities acquired by tempering.

Evidently that steel which preserves its original qualities right up to the tempering temperature will be the best suited for work at elevated temperatures.

Fig. 5 shows that steels AE179, A18 and A14 are pronouncedly inclined to temper brittleness. Prolonged heating at 617 deg. F. of steel A10 lowered its impact strength by about 30 per cent, that is, it showed its inclination to temper brittleness. At higher temperatures and prolonged heating the impact strength greatly increased compared with the original strength. Parallel to the increase of impact strength, hardness lessened, that is, the steel became softer and changed its properties, including impact strength.

Steels 30XMUA, AXTB, AE10, A5XMF, A18M, AE84, A5XNM and A20 keep their impact strength even after prolonged heating. The temperature limits for prolonged heating, at which the original hardness is preserved, varies for the different steels and especially for those in the last group (Table III.)

Thus, steels 30XMA, 35XMUA, AXTB, A14, AE84, A5XNM, A20 and AE10 that is, steels alloyed with either molybdenum or vanadium or both, keep their original qualities after prolonged heating.

From the data given it is evident that the effect of heat treatment for the majority of these steels is preserved, if the working temperature of metals is 212 deg. F. less than the tempering temperature.

Conclusions

In comparing the results of the experiments, it was found that high temperature strength, creep strength, freedom from temper brittleness and preservation of qualities acquired through heat treatment at 842 deg. to 1022 deg. F. is found in steels AE10 and A20 between 662 deg. and 1022 deg. F. in steels 30XMA, A5XMF and A18M. A satisfactory combination of mechanical properties is achieved in steels A5XNM, A18 and 35XMUA; but the other specifications are preferred because they are more stable and are not at all inclined to temper brittleness. (Steel A18 has a great tendency to temper brittleness after a prolonged heating at 887 deg. F. when its tensile strength is reduced by 53.5 per cent.)

Steels A4XC, AE179 and A10 do not preserve the mechanical characteristics obtained by heat treatment in prolonged heating at temperatures higher than 752 deg. F., with which feature their high creep is probably connected. Steels A10 and AE179 are pronouncedly inclined to temper brittleness. These steels should not be used for bolts as such; perhaps they can act as substitutes for carbon steel up to 662 deg. F. in high tensile flange connections where it is impossible to place a sufficient quantity of carbon steel bolts.

(1) Steel ST5 can be used for stay bolts satisfactorily up to 662 deg. F. in applications which are not highly stressed.

(2) When the bolts are under considerable stress up to 662 deg. F., chromium-nickel (A10 type and others) steels A4XC and AE179 can be used.

TABLE III

Retention of Hardness Under Prolonged Heating

Steel Desig.	Tempering Temperature Deg. F	Temperature up to which Hardness is Retained in Prolonged Heating Deg. F	Temperature Difference Between Tempering and Prolonged Heating Deg. F
A4XC	1020	620	400
AE179	1110	750	360
30XMA	1110	1020	90
35XMUA	1200	1020	180
A10	1070	620	450
AXTB	1110	880	230
AE10	1200	880	320
A5XMF	1200	880	320
A18	1070	620	450
A14	1080	880	200
A18M	1200	880	320
AE84	1080	880	200
A5XNM	1110	880	230
A20	1155	1020	135

(3) Steels AE10 and A20 can be used under stress up to 1022 deg. F. The former is preferred, as it is cheaper and more easily machined.

(4) Steel 30XMA can also be used up to 932 deg. F. It may be replaced by A5XNM,35XMUA,A18M,A5XMF, but these steels are more expensive.

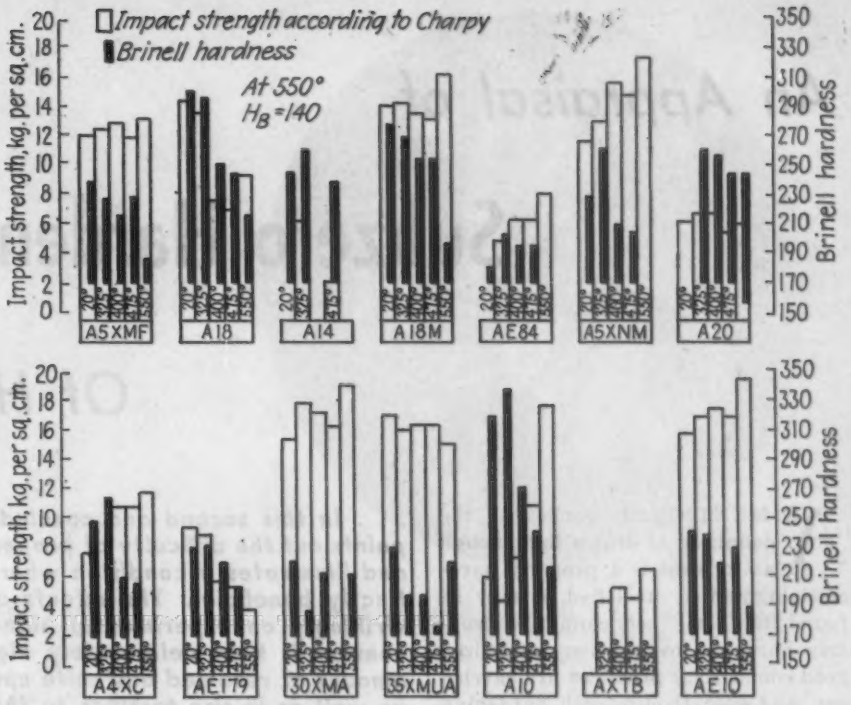
(5) Steels AXTB and AE84 can be used as bolt steels in some cases at temperatures of 662 deg. to 932 deg. F. However, their strength is only 70 per cent of 3OXMA and can, therefore, not be recommended as substitutes for this steel.

(6) Steel A14 is expensive and inclined to temper brittleness, and is, therefore, not recommended.

(7) Steel A18 can be applied in the temperature range between 662 deg. and 932 deg. F. but by its mechanical properties are inferior to steels 30XMA, A5XNM, A5XMF, A18M and 35XMUA.

(8) In all these steels, molybdenum either prevented or so considerably reduced the inclination to temper brittleness that it was practically eliminated especially when the part was subjected to intermittent high temperature service.

(9) Molybdenum steels keep their properties after heat treatment even after prolonged service at temperatures approaching those of tempering. Vanadium shows similar behavior but to a lesser extent than that of molybdenum.



• • • Fig. 5—Charpy impact strength and Brinell hardness after successive heating and cooling.

Flexible Infra-Red Drying Installation

INFRA-RED ray drying is not new, but a recent installation at the East Springfield works of Westinghouse has some unusual features that make it more versatile than the usual setup. It is unnecessary to revolve the work passing through the drying area because the lamps are so positioned that there are no blind spots, as usually is the case when bulbs larger than the 250 watt lamp are used in the reflectors.

There is a total of 450 250-watt lamps having a combined wattage of 112.5 kw. in the installation. There are ten panels of 45 lamps; these are divided 15 to a row, with a switch for eight bulbs and another for seven. The banks are connected vertically. Thus, when small work is being dried and all the bulbs are not needed, some can be cut out to reduce the cost of operation. Parts dried in the oven range from a fabricated case weighing 65 lb. to all types of small miscellaneous formed pieces.

The frame is made in two parts, one of which is equipped with castors; it can be unhooked and rolled back to allow lamp replacements or repairs to be made. This also allows the distance from the lamps to the work to be adjusted with ease.

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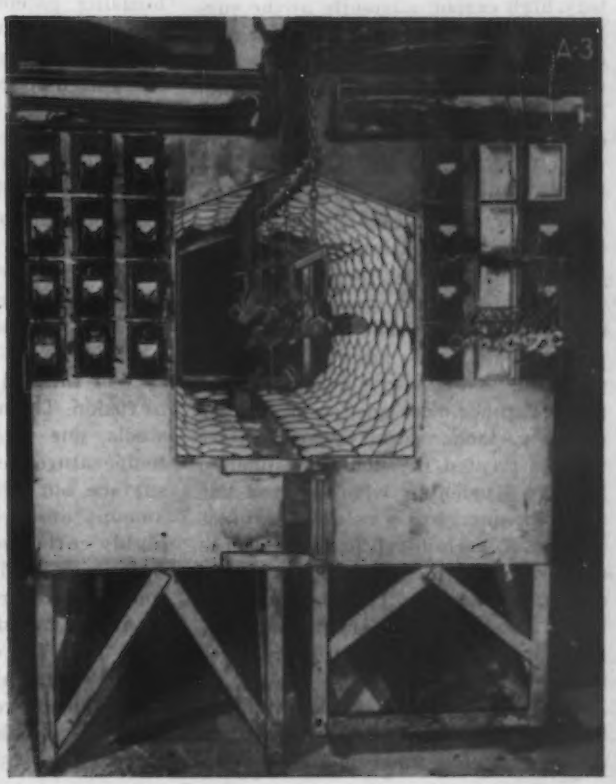

The frame for the right hand bank of infra-red lamps is mounted on casters, permitting flexibility in arrangement.

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An Appraisal of

Subzero Hardening

Of High-Speed Steel

. . . In this second and concluding part of the article, the author points out the difficulty of properly hardening high-speed steel tools and illustrates a condition where subzero cooling might prove distinctly beneficial. The effects of cold treatment are brought out strikingly on experimental high-speed steels in which the carbon content is kept deliberately high in order to insure an excessive amount of retained austenite upon hardening. Increase in hardness as well as in size testifies to the marked effect that treating such specimens at —120 deg. F. has on the transformation of austenite.

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AS MENTIONED earlier, if the definition is drawn fine enough as to what is a properly hardened high-speed steel tool, it may be found that some tools cannot be properly hardened even when recognized good commercial practices are carried out, and even though such hardening may produce excellent tools.

It has been demonstrated by Schlegel[8] and Morrison[9] that when 18-4-1 steel is austenitized in carbonaceous atmospheres (as CO and CO_2) a carburization takes place during the heatup period in the superheat and is followed by a decarburizing action of greatly diminished rate after the tool surface reaches the superheat temperature. Depending on the time cycle in the superheat and the extent of subsequent surface abrading, as by a blast cleaning, in a normal 18-4-1 steel, there will be more or less refractory high carbon austenite at the surface. Under the best commercial conditions this carbon "pick-up" may amount to as much as 20 points carbon in a 0.70 carbon 18-4-1 steel on a cut 0.001 in. to 0.002 in. below the surface. If the definition for a properly hardened tool were based on obtaining in such a steel a carbon distribution at the surface as uniform after austenizing as it was before, or that the surface carbon would not vary more than 0.02 per cent from the original, it would not be possible to accomplish this end in a commercial atmosphere furnace. Yet good tools, in fact superior tools, result when 18-4-1 steel is treated in such atmospheres. Subzero hardening when carried out after the quench is a valuable adjunct in that it permits of harnessing the superior good residing in these higher carbon surfaces as it is a most effective method for transforming this surface austenite, which is refractory to tempering.

The degree of usual carburization incidental to superheating 18-4-1 steel in carbonaceous atmospheres as commercially done should not be confused with the inordinate carburization which occurs in certain atmospheres so high in CO that an excessive carburizing potential prevails throughout the entire superheat cycle.

Heat-treating equipment for hardening high-speed steel that employs atmospheres which are extremely rich in carbon monoxide (about 22 per cent CO and higher) and which are highly carburizing to the superheated steel, have not been successful in treating 18-4-1 steel and none too successful in treating the various molybdenum high-speed steels. In the case of 18-4-1 steel the carburizing potential at 2350 deg. F. is so great that the surface of the tool becomes wrinkled due to fusion. The molybdenum high-speed steels, due to the lower austenizing temperatures used, do not fuse at the surface but absorb a considerable amount of carbon. The result is a highly carburized surface, an austenite so rich in alloy carbide that a reasonable number of draws do not substantially transform it. It is quite possible that for certain tools made of molybdenum high-speed steel, such rich atmospheres might be profitably exploited if subzero cooling were employed after quenching; also insofar as the highly austenitic cases are concerned beneficial effects may be possible even after one or more temperings.

Effect of Rich Surface Austenite

Figs. 5 and 6 illustrate a circumstance where subzero cooling might prove distinctly beneficial. A specimen of Mo-Max molybdenum high-speed steel was hardened from a furnace at 2240 deg. F. using an atmosphere containing 34 per cent CO. The austenizing temperature may appear high but it is not unduly so for this type atmosphere. It is estimated from other work that the surface carbon approximates 1.50 per cent in a steel having an original carbon content of 0.75 per cent. The 34 per cent CO atmosphere is highly carburizing and a ½ x 1¼ x 4 in. sample after tempering at 1050 deg. F. for 1 hr. showed a relatively pure austenite for a depth of 0.0025 in. and a total carburized depth of approximately 0.0048 in. A specimen ½ in. long was nicked from the middle of the 4 in. long sample. It was then polished on the face which had been an exterior or as-quenched surface; the same specimen was also polished on a face

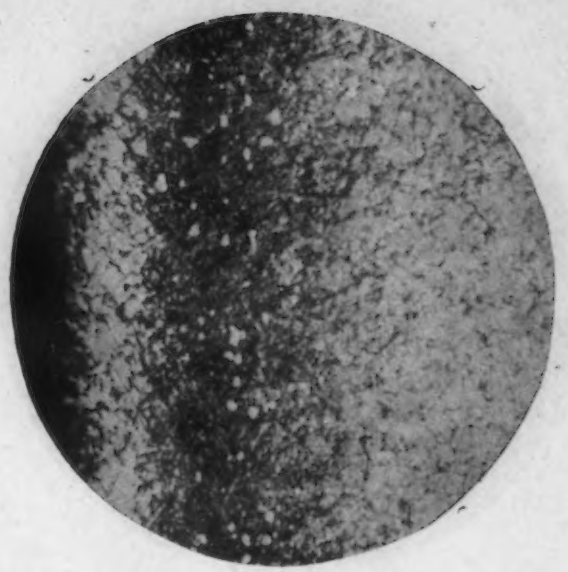

FIG. 5—Mo-Max specimen cut from sample austenized at 2240 deg. F. in a 34 per cent CO atmosphere, drawn at 1050 deg. for 1 hr., then nitrided at 1050 deg. for 1 hr. This section of an edge 0.0006 in. below the originally treated surface shows that the austenite has prevented the ingress of nitrogen. Nital etch, 500X.

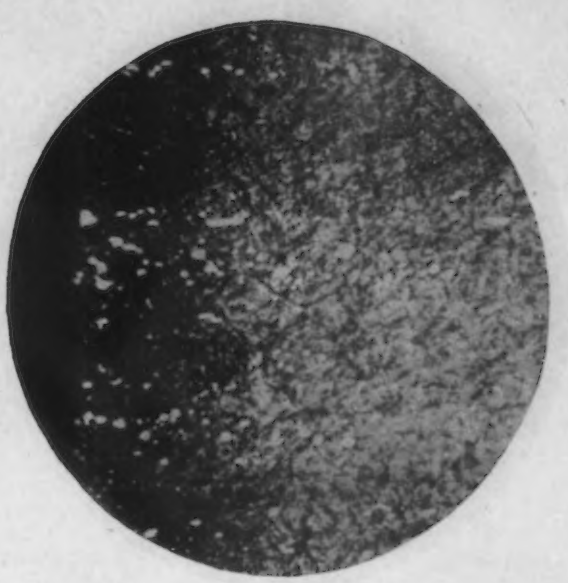

FIG. 6—Same specimen as Fig. 5 but a section of an originally interior face. Normal nitride case is indicated. Nital each, 500X.

which had been the interior of the hardened sample. About 0.0006 in. of the as-quenched surface was removed in the polish operation. The specimen was then liquid nitrided for 1 hr. at 1050 deg. F. It was then nicked and a section of what had originally been the as-quenched surface polished and etched.

Fig. 5 illustrates that the nitrogen did not diffuse into the austenitic case to any appreciable extent. The dark area, or middle zone, in the micrograph has etched more rapidly than the "core" metal not because of any absorbed nitrogen but because of the critical carbon content of this zone. The white austenitic zone in Fig. 5 is frequently mistaken for decarburization when examined under the microscope. Its high carbon nature is unmistakable due to the minute needles of martensite which may be observed. The microscope, it may be noted, has very severe limitations when attempts are made to substitute it for a carbon analysis.

Fig. 6 is a polished and etched section of the sample on what had been an interior face. It shows a normal nitride case of about 0.0015 in. Microhardness tests show an equivalent Brinell number of 1050 on the surface which accepted the nitrogen and 850 on the austenitic surface. The high hardness of the latter may be the result of cold working effects in the polish preparation plus a possible superficial nitriding to depth of 0.00003 in. as a result. The microhardness test would be quite sensitive to even this thin layer of relatively hard material.

In view of the results previously outlined on the experimental case carburization of various high-speed steels, it was felt that if several experimental high-carbon molybdenum high-speed steel heats were prepared it might be easier to follow the effects of subzero cooling. By greatly increasing the amount of retained austenite on quenching or by obtaining a structure of relatively pure austenite plus excess carbide it would be possible to magnify the subzero cooling effects on such rich austenite crystals, which form only a small percentage of the whole in the commercial prototypes. An exception might be taken to the use of extremely high carbon high-speed steels since they are not commercially used. However, there is perhaps as much justification for this as there is to magnify a structure 500 times so as to bring it within one's limit of vision.

The several experimental analyses melted were very high-carbon equivalents of the commercial 0.85 per cent carbon-molybdenum-vanadium high-speed steel and of the 0.80 per cent carbon-5.5 per cent tungsten-4.5 per

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FIG. 7 — Hardness curves showing the comparison of specimens of steels V and S austenized at 2210 deg. F. and (1) multiple tempered at 1050 deg. F. after quenching and (2) drawn at 700 deg. after quenching, then cooled to —120 deg. followed by multiple tempering.

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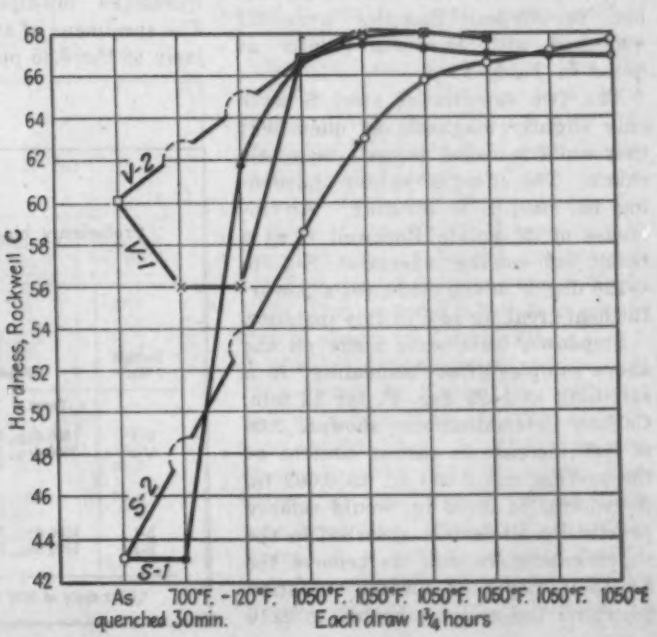

FIG. 8—Rockwell C impression on steel S as quenched from 2210 deg. F. showing several minute cracks radiating from periphery; also the relatively jagged contour due to the cold working effect of the Brale indentation. Unetched, 100X.

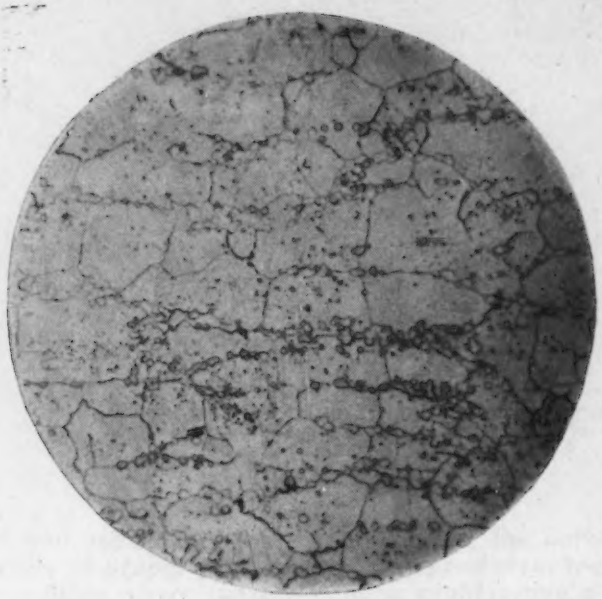

FIG. 9—Steel S as quenched from 2210 deg. F. Hardness 47.5 Rc. Etched in 4 per cent nital for 7½ min., 500X.

cent molybdenum-1.5 per cent vanadium high-speed steel. The analyses of the two experimental heats are listed below:

	Analysis, Per Cent								
Symbol	C	Mn	P	S	Si	Cr	W	V	Mo
V	1.20	0.20	0.017	0.012	0.47	4.26	....	1.84	8.45
S	1.27	0.23	0.029	0.011	0.26	3.85	5.47	1.46	4.37

The small ingots were forged to 1⅛ in. diameter. Preliminary tests were conducted to determine the effect on the surface carbon when 1 in. diameter samples, 4½ in. long, were hardened from an electrode heated, acid barium chloride salt bath at temperatures approximating the proper temperatures for their commercial carbon prototypes. Samples were oil quenched with hardness results as listed in Table V.

The two samples of steel S were only slightly magnetic as quenched; they could be rolled across a magnetic chuck. The effect of subzero hardening on steel S is striking. An increase of 20 points Rockwell C as a result of cooling specimen S-2 to —120 deg. F. alone evidences a powerful heat-treating tool in this instance.

Stepdown tests were made on the above samples after "annealing" in a salt bath at 1425 deg. F. for 12 min. Carbon determinations showed 0.06 to 0.08 increase in carbon content on the surface cut 0.000 in. to 0.003 in. A removal of 0.005 in. would remove practically all carbon absorbed in the superheating as well as remove the 0.0015 in. depth of surface oxidation found on the samples heated to 2210 deg. F. The Rockwell C hardness numbers listed in Table VI were made on the ends of the bars after merely brightening the surface. Rockwell impressions made at or near the originally hardened surface show quite jagged contours occasioned by the oxidized surface plus the cold working effect of the indentation. The Rockwell numbers are therefore not deemed very accurate.

Fig. 7 shows the hardness curves resulting when 1 in. diameter by ½ in. thick specimens of steels V and S, austenized at 2210 deg. F., are tempered at 700 deg. F., cooled to —120 deg. F. and multiple tempered at 1050 deg. F. compared with companion specimens multiple tempered only. The specimens of steel V behave similarly to the 0.85 per cent carbon commercial prototype. On specimen V-1 the 700 deg. F. draw reduced the hardness from 60.0 to 56.0 Rc; on cooling to —120 deg. F. no change in hardness resulted. Specimen V-1 multiple tempered at 1050 deg. F. together with specimen V-2 gave identical hardness numbers after the respective draws.

In contrast to steel V the S-1 specimen when drawn at 700 deg. F. showed no change in hardness but when cooled to —120 deg. F. the hardness was increased from 43.0 to 61.8 Rc. Specimen S-2 multiple tempered only at 1050 deg. F. shows an ascending hardness after five draws of 1¾ hr. each. After six such draws the specimen still retains some austenite. The S-1 specimen after two draws shows a descending hardness and a

TABLE V

Preliminary Hardness Tests on Two High-Speed Steel Samples to Determine Effect of Surface Carbon

Sample No.	Preheat		Superheat		Rockwell C Hardness			
					As Quenched	*1050 Deg. F.	1050 Deg. F.	1050 Deg. F.
	Temp.	Time	Temp.	Time				
V-1	1500 deg.,	7 min.	2175 deg.,	3 min., 30 sec.	60.5	65.7	66.9	67.5
V-2	1500 deg.,	7 min.	2175 deg.,	5 min., 00 sec.	59.7	65.7	66.7	67.5
					As Quenched	—120 Deg. F.	1050 Deg. F.	1050 Deg. F.
S-1	1500 deg.,	7 min.	2210 deg.,	3 min., 30 sec.	41.0	60.1	66.0	67.0
S-2	1500 deg.,	7 min.	2210 deg.,	5 min., 00 sec.	39.0	59.0	65.4	67.0

* Each draw at 1050 deg. F. for 1¾ hr.

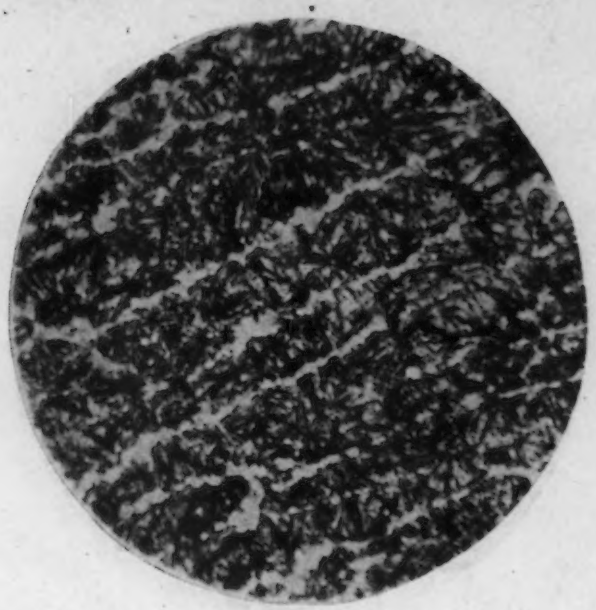

FIG. 10—Steel S as quenched from 2210 deg. F., cooled to —120 deg. and drawn three times at 1050 deg. for 1¾ hr. each. Hardness 67.6 Rc. Etched in 4 per cent nital for 1 min., 500X.

FIG. 11—Steel S quenched from 2210 deg. F. and given three draws at 1050 deg. for 1¾ hr. each. Hardness 66 Rc. Etched in 4 per cent nital for 1 min., 500X.

microscopic inspection after three draws indicates the substantial transformation of all residual austenite. The subzero specimen, S-1, draws back in hardness at a faster rate than the S-2 specimen which was not subzero treated.

Size Changes Examined

Following the preliminary tests on the steel V and S a number of specimens were carefully ground to ⅞ in. diameter by about 1 in. long Specimens were measured for diameter and for length. Three specimens of each steel were hardened at the same time in a perforated steel basket from a salt bath furnace at respective temperatures of 2100 deg. F. and 2210 deg. F. After quenching in oil specimens were decreased, washed, the surface brightened with a mildly abrasive eraser and again measured for diameter and length. The specimens were then carefully ground parallel on the ends, care being taken that 0.005 to 0.007 in. was removed from the end opposite the specimen number. One specimen of each group was drawn at 700 deg. F., followed by subzero cooling to —120 deg. F.; one specimen was taken down to —120 deg. F. about 12 hr. after quenching. The third specimen was tempered at 1050 deg. F. together with the other two specimens. The specimens were then given a second and a third draw at 1050 deg. F., the diameter and length changes being recorded after each individual operation.

After the 700 deg. F. draw the specimens were brightened with an abrasive eraser; after each of the 1050 deg. F. draws the specimens were pickled in cold 25 per cent HCl, using an inhibitor. Weight changes due to heating in the salt bath, in hardening and to the scaling in tempering were made. The order of accuracy in measurement on all operations following the grinding of the ends after quenching is within +0.0001 in. to —0.0002 in., taking into consideration surface loss through scaling, slight distortion and the limitations of the vernier micrometer used in making such measurements. It is believed that measurements are sufficiently accurate to disclose the pattern. All specimens were preheated at 1500 deg. F. for 7 min. The 2100 deg. F. specimens were in the bath for a total time of 3 min. 15 sec. and the 2210 deg. F. specimens for 3 min. For brevity the change in diameter and in length due to each treating operation are given in Table VII. The hardness after each operation is shown in Table VIII.

Within experimental error, the data listed in Table VII indicate: (1) no volume change after tempering at 700 deg. F. following the quench on the S-17 specimen austenized at 2210 deg. F.; on all other specimens the 700 deg. F. draw resulted in a definite constriction in volume, probably the result of the change in the primary martensite

TABLE VI

Size and Hardness Changes as a Result of Subzero Treating 1.27 Per Cent Carbon Molybdenum-Tungsten Steel (Steel S)

Sample S-1*	Diameter, In.	Change, In.	Length, In.	Change, In.	Hardness, Rockwell C
Condition					
Soft	0.9978	.....	.....	.....	23.5
As-quenched	0.9930	−0.0048	4.4700	.....	41.0
—120 deg. F.	0.9988	+0.0058	4.4928	+0.0228	60.1
1050 deg. 1¾ hr.	0.9978	−0.0010	4.4910	−0.0018	66.0
1050 deg. 1¾ hr.	0.9978	0.0000	4.4910	0.0000	67.0
Sample S-2**					
Soft	0.9979	.....	.....	.....	23.5
As-quenched	0.9930	−0.0049	4.5464	.....	39.0
—120 deg. F.	0.9982	+0.0052	4.5675	+0.0211	59.0
Ends polished to	.....	.....	4.5660	.....	.....
1050 deg. 1¾ hr.	0.9978	−0.0004	4.5637	−0.0023	65.4
1050 deg. 1¾ hr.	0.9978	0.0000	4.5653	+0.0016	67.0

* Austenized at 2210 deg. F. for 3½ min.
** Austenized at 2210 deg. F. for 5 min.
Both samples approximately 1 in. diam. x 4½ in. long

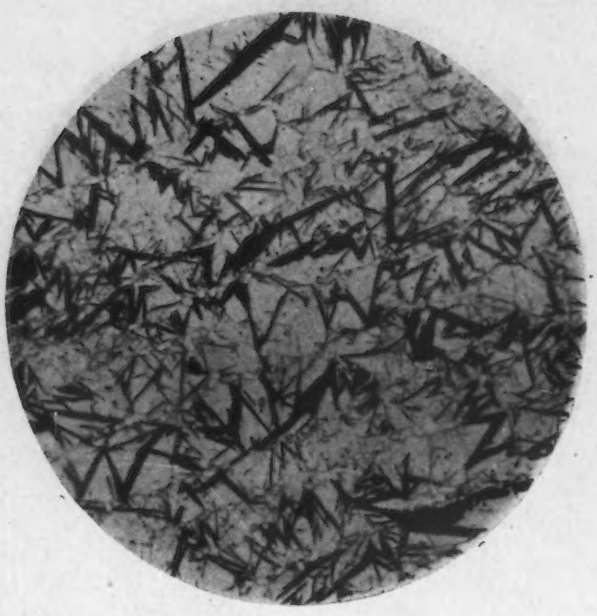

FIG. 12—Steel S quenched from 2210 deg. F. and drawn at 1050 deg. for 1¾ hr. Hardness 60.5 Rc. Etched in 4 per cent nital for 2 min., 500X.

FIG. 13—Steel S quenched from 2210 deg. F., drawn at 1050 deg. for 1¾ hr. and then cooled to —120 deg. Hardness 65.8 Rc. Etched in 4 per cent nital for 2 min., 500X.

present in these specimens. (2) The greatest change in volume occurred when the specimens were subzero treated following the quench. In all cases where the subzero cooling followed the quench there was a contriction in volume after the first 1050 deg. F. tempering. Measurements of the soft and as-quenched specimens as listed in Table VII have no significance as regards volume change since the considerable and variable loss due to solubility of the specimen surface in the super-heat bath vitiate a comparison.

In Table VI hardness numbers of 39 and 41 Rc are listed as the hardness of two specimens austenized at 2210 deg. F. for respective periods of 3 min. 30 sec. and 5 min. Just what the true hardness may be is problematical, due to the very noticeable cold working effect of the indenting by the Brale. On these several specimens the contour of the Rockwell C impression was jagged and relatively large cracks radiated from the peripheries of the impressions. In Fig. 8 the Rockwell C impression, taken at 100 diameters on a polished surface approximately 0.005 in. below the as-quenched surface of a steel S austenitized at 2210 deg. F. shows a somewhat ragged contour and a few minute peripheral cracks. Relatively, however, the impression is sufficiently clean cut to indicate a hardness of 47.5 Rc, approximating the hardness of relatively pure austenite plus carbide. The very considerable excess carbide suggests a much lower hardness for a rich (in dissolved carbide) pure austenite.

TABLE VII

Dimensional Changes in Diameter and Length (Inches in Operation to Operation) in Treating 1.20 Per Cent Carbon Molybdenum-Vanadium (Steel V) and 1.27 Per Cent Carbon Tungsten-Molybdenum (Steel S) High-Speed Steels

Specimen No.	Austenizing Temperature and Time	As-Quenched, In.	Drawn 700 Deg. F, In.	Cooled —120 Deg. F, In.	Multiple Tempered: First, 1050 Deg. F,* In.	Second, 1050 Deg. F, In.	Third, 1050 Deg. F, In.
		Diameter Changes					
V-2	2100 deg. F 3¼ min.	−0.0003	−0.0008	−0.0003	+0.0014	+0.0002	−0.0001
V-3		−0.0003	.....	+0.0011	−0.0005	−0.0001	0.0000
V-4		−0.0003	.....	.....	+0.0009	0.0000	0.0000
S-10		−0.0023	−0.0006	+0.0017	+0.0005	+0.0004	0.0000
S-11		−0.0021	.....	+0.0040	−0.0009	+0.0001	−0.0002
S-12		−0.0023	.....	.....	+0.0009	+0.0006	0.0000
V-5	2210 Deg. F-3 min.	−0.0032	−0.0005	0.0000	+0.0022	+0.0005	0.0000
V-6		−0.0033	.....	+0.0030	−0.0001	−0.0001	0.0000
V-7		−0.0034	.....	.....	+0.0018	+0.0006	0.0000
S-15		−0.0042	0.0000	+0.0039	−0.0003	+0.0001	+0.0001
S-16		−0.0041	.....	+0.0048	−0.0011	+0.0003	0.0000
S-17		−0.0043	.....	.....	+0.0010	+0.0005	+0.0003
		Length Changes					
V-2	2100 Deg. F-3¼ min.	+0.0020	−0.0009	0.0000	+0.0014	+0.0003	−0.0001
V-3		+0.0021	.....	+0.0015	−0.0010	+0.0002	−0.0001
V-4		+0.0020	.....	.....	+0.0006	+0.0002	0.0000
S-10		−0.0005	−0.0005	+0.0009	+0.0014	+0.0005	0.0000
S-11		−0.0001	.....	+0.0040	−0.0007	+0.0001	0.0000
S-12		−0.0005	.....	.....	+0.0015	+0.0010	−0.0002
V-5	2210 Deg. F-3 min.	+0.0037	−0.0005	−0.0001	+0.0024	+0.0005	0.0000
V-6		+0.0034	.....	+0.0028	−0.0001	+0.0001	0.0000
V-7		+0.0038	.....	.....	+0.0017	+0.0010	0.0000
S-15		+0.0013	−0.0002	+0.0036	+0.0001	+0.0005	0.0000
S-16		+0.0011	.....	+0.0016	−0.0005	+0.0004	−0.0001
S-17		+0.0011	.....	.....	+0.0017	+0.0011	+0.0008

* Each draw 1050 deg. F for 1¾ hr.
Annealed samples ⅞ in. in. diam. by 1 in. long.

Study of Microstructures

Fig. 9 illustrates the structure of steel S as quenched from 2210 deg. F. A grain size of about 11 is indicated.

Figs. 10 and 11 illustrate the great influence of the subzero treatment when carried out after the quench. Specimens Nos. 16 and 17 (Refer to Tables VII and VIII) were processed on all heat treating operations at the

FIG. 14—Steel S quenched from 2210 deg. F. and double drawn at 1050 deg. for 1¾ hr. Hardness 64.8 Rc. Etched in 4 per cent nital for 1 min., 500X.

FIG. 15—Steel S quenched from 2210 deg. F., double drawn at 1050 deg. for 1¾ hr. and then cooled to —120 deg. Hardness 67.5 Rc. Etched in 4 per cent nital for 1 min., 500X.

same time with the exception that specimen No. 16 was subzero treated after quenching. After three draws at 1050 deg. F. the subzero treated specimen shows a hardness number of 67.6 Rc and a microstructure indicating substantial transformation of residual austenite. Fig. 11 for the companion specimen (No. 17), which was tempered at the same three times as specimen No. 16 but not subzero treated, reveals a quite considerable amount of residual austenite. The hardness of specimen No. 17 is 66.0 Rc.

Figs. 12 to 16 show the relative effect on the microstructures of specimens of steel S, austenitized at 2210 deg. F. and (1) tempered only, (2) tempered and subzero treated, (3) double tempered, (4) double tempered and subzero treated and (5) tempered, subzero treated and retempered.

Fig. 13 shows a structure practically indistinguishable from Fig. 12, yet the specimen tempered at 1050 deg. F. for 1¾ hr. has a hardness of only 60.5 Rc compared to a hardness of the tempered and subzero treated specimen of 65.8 Rc.

Fig. 14 shows the structure obtained after double tempering at 1050 deg. F. for 1¾ hr. Fig. 15, where the specimen was tempered at the same time as the specimen of Fig. 14 but subsequently subzero treated suggests, if anything, slightly more austenite present than is indicated in the specimen of Fig. 14. This is attributed to the segregated nature of this steel. The subzero treated specimen shows a hardness number of 67.5 Rc compared to 64.8 Rc for the double tempered sample.

Fig. 16 shows the effect on the structure when a specimen of steel S is tempered, then subzero treated followed by a retempering. There would appear to be much less austenite in the specimen which received the second draw with a subzero cooling sandwiched betweeen the two draws as compared to the structure of the double drawn specimen subsequently subzero cooled as depicted in Fig. 15.

The foregoing micrographs illustrate quite conclusively that qualitative micrographs should not be used to determine quantitatively the amount of austenite present.

That the subzero cooling of steel S would effect transformation after a draw of 1050 deg. F. of 1¾ hr. is easily comprehended. What martensite did form resulted in the austenite decomposition on cooling from the 1050 deg. temperature and is primary martensite since the as-quenched specimen is practically pure austenite plus excess carbide.

In the case of the double tempered specimen, Fig. 15, which was marked-

TABLE VIII

Comparison of the Rockwell C Hardness of Specimens of High-Carbon High-Speed Steels V and S After Three Cycles of Heat Treatment. All Coincidental Operations Carried Out at the Same Time

Specimen No.	Annealed	ROCKWELL C HARDNESS					
					Multiple Tempered		
		As-Quenched *	Drawn 700 Deg. F	Cooled —120 Deg. F	First 1050 Deg. F	Second 1050 Deg. F	Third 1050 Deg. F
V-2	18.5	64.8	60.5	60.5	66.0	65.7	65.6
V-3	18.5	65.0	....	67.2	64.9	64.9	64.6
V-4	18.5	64.5	....	....	66.5	66.4	65.6
V-5	18.5	60.0	56.0	55.8	67.1	66.3	66.4
V-6	18.5	60.5	....	66.2	67.8	67.3	66.8
V-7	18.5	60.3	....	....	66.8	66.5	66.5
S-10	23.5	55.4	55.0	56.5	65.0	66.3	66.2
S-11	23.5	55.5	....	65.4	65.3	65.3	64.8
S-12	23.5	55.5	....	....	63.7	65.9	66.1
S-15	23.5	46.3	46.2	59.8	65.0	67.5	67.5
S-16	23.5	47.1	....	62.0	67.1	67.6	67.6
S-17	23.5	46.9	....	....	58.8	63.8	66.0

* Surface tested 0.005 in. to 0.007 in. below as-quenched surface.
Where no hardness values are recorded, steel not subjected to that particular treatment.

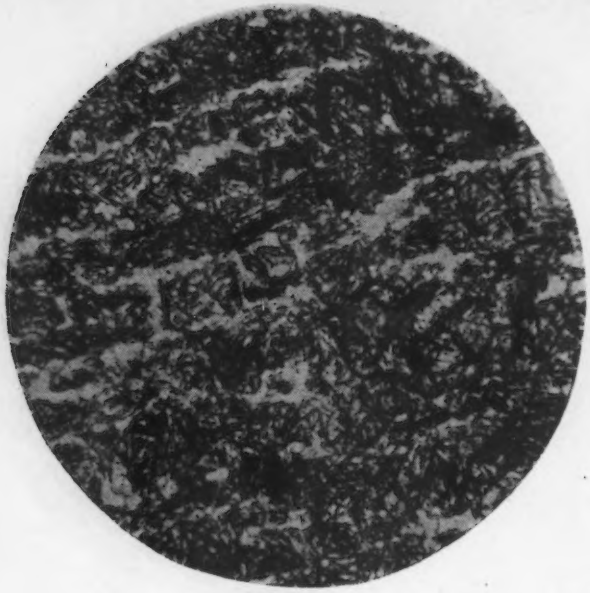

FIG. 16—Steel S quenched from 2210 deg. F., drawn at 1050 deg. for 1¾ hr., cooled to —120 deg. and redrawn at 1050 for 1¾ hr. Hardness 67.5 Rc. Etched in 4 per cent nital for 1 min., 500X.

ly affected by the subsequent subzero cooling, this transformation may probably be due to the kind of martensite present after the second temper. Is it the quantity of martensite resulting from the transformation due to the first draw; is it the richness (in carbide) of this martensite which may have made it quite refractory to the second draw, or is it the quantity (relative to its commercial prototype not great) of the tempered primary martensite?

That commercial high-speed steels are unaffected when the subzero cooling is carried out after one or more draws is probably due to the very considerable percentage of martensite in the quenched state plus the chemical variability of the martensite crystals. Some of these crystals, because they are lean in dissolved carbide, are very sensitive to the change from tetragonal martensite to cubic martensite with a concomitant constriction in crystal volume.

If the reader will refer back to the microphotograph, Fig. 5, which shows a section at the surface of high speed steel highly carburized in austenizing because of the atmosphere used, he may understand why subzero hardening might be beneficial even after double tempering. In the case of the specimen illustrated in Fig. 5 the surface carbon (0.0005 in to 0.002 in.) in the as-quenched sample, as estimated from other work approximates 1.50 per cent. This surface austenite is so rich in dissolved carbide that locally there is little distinction between the surface area and the total area of the specimens of steel S austenized at 2210 deg. F. The writer hastens to add, however, that one will find very few of the commercial high speed steel tools that will contain a surface austenite as rich in carbide as that illustrated in Fig. 5.

The foregoing adds a little but still leaves much to be told about the subzero treatment of high-speed steel. The great chemical variability of the crystals residing in the same piece of quenched high-speed steel and the generic chemical nature of both the austenite and the resultant martensites make a most interesting, but by no means simple matter for orchestration by heat treaters and metallurgists. The discussion does lead to a simple consideration: As organic chemistry is the chemistry of the carbon atom, so the heat treatment of high-speed steel, and all thereof after the steel is once cast into the mold, is also the chemistry of the carbon atom.

Acknowledgment

The writer wishes to thank the Vanadium Alloys Steel Co. for furnishing the two heats of high-carbon molybdenum high-speed steel and for making the several microphotographs.

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Failures in Rammed Carbon Blast Furnace Linings

IN an article on failures of blast furnace refractory linings and the ramming of carbon aggregates appearing in *Stahl und Eisen*, vol. 64, Dec. 7, 1944, pp. 774 to 781, R. Klesper cites one failure discovered on drilling the shell plate around a carbon-lined hearth which had been in operation for two years. A space about 1½ to 2½ in. wide was found between the back of the rammed lining and the plate, and the lining itself had vertical cracks in it which were full of loose powder. It is probable, Klesper suggests, that starting the furnace too quickly was the initial cause of this failure. The correct preheating of the mix is very important because if it is made too hot, the heavier hydrocarbons in the tar are cracked and its binding properties are destroyed. Crushed coke mixed with tar should be prepared for ramming by heating to 212 deg. F. on an iron plate heated with steam or by a coke-oven gas flame.

Tests were made by building up blocks from layers of ramming material with and without a coating of tar between the layers. After curing, the tar coating became a tin porous layer of loose carbon powder, while the blocks made without tar coatings were hard and homogeneous throughout. Roughening of the top of one layer before applying the next layer, even after 24 hr. aging, was quite sufficient to insure complete fusion of the joint during curing.

Since the requirements for the protective brickwork in the case of a rammed carbon hearth are much more exacting than for a hearth made of carbon blocks, the wall in the former case should be at least 10 in. thick.

It is still a moot question whether a rammed carbon hearth can be used for smelting lead-bearing ores since it is believed that lead cannot penetrate such a hearth.

New Equipment . . .

Presses

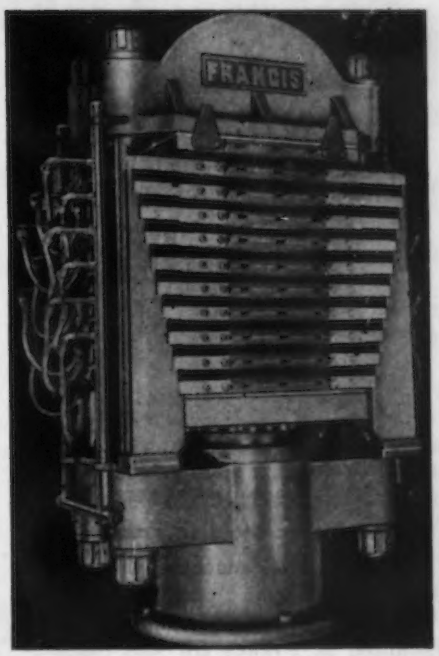
. . . Recent developments in hydraulic, plastic molding and broaching presses and press accessories are described in the following pages.

A LINE of hydraulic assembly presses has been announced by *Colonial Broach Co.*, Box 37, Harper Station, Detroit 13. The machines are

available in capacity ratings of 15, 20, 35 and 50 tons. Motors are built in and the direct acting hydraulic cylinder which operates the ram is built into the head of the press. Normal ram speed on the power stroke ranges from 180 in. per min. on the 15-ton press to 60 in. per min. on the 50-ton press. Ram speed is set by means of the speed control valve located on the right-hand side of the machine column. The return speed of each size machine is constant regardless of its downward speed, ranging from 360 in. per min. for the 15-ton press to 120 in. per min. for the 50-ton press. However, ram speeds are adjustable over a wide range to meet the assembly needs of different applications. Ram speed is set by means of the speed control valve located on the right-hand side of the machine. The presses are equipped with pressure control valve, hand control, and a pressure gage for decision assembly operations. Ram speeds and maximum pressures are both adjustable, making the hydraulic pressure effective in limiting press action. Presses range from 15 to 50-ton capacity.

Hydraulic Press

A GENERAL purpose steam plate hydraulic press has been announced by *Charles E. Francis Co.*, Huntington, Ind. Among features of

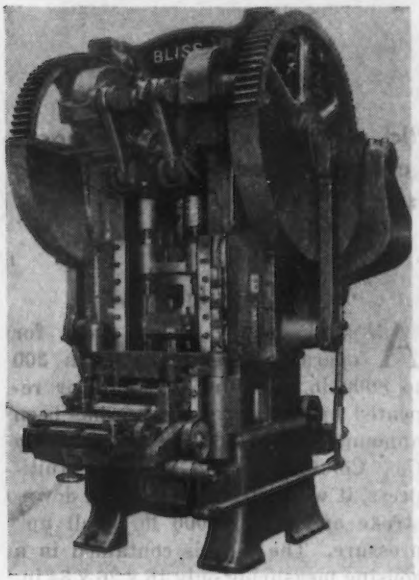


the machine are a strong plate support, "V's" for easy loading and a special locking device on strain rod nuts to prevent unscrewing. Illustrated is a 30 x 30 x 2 ft., 153-ton capacity hydraulic general purpose press with motor driven pump unit, automatic pressure and temperature control equipped with 11 steam plates. It is said that the press can be furnished with 14 or 16-in. diameter cylinder and with or without pumping unit.

Bench Press

AN oil-hydraulic bench press for operations requiring from 300 to 8000 lb. pressure in single or repeated up and down strokes has been announced by *Denison Engineering Co.*, Columbus, Ohio. Called Multipress, it will deliver up to 4 ton downstroke and up to 5000 lb. "pull up" pressure. The unit is contained in a housing measuring only 16 x 26 x 34 in. and weighs 745 lb. In addition, it has been especially designed to use a wide variety of accessories and fixtures with which it can perform innumerable production operations, such as pelleting, honing, broaching, peening, assembling, burnishing, straightening, etc. Daylight opening is 11 in., table is 16 x 10½ in., throat opening 6 in. A 3-hp. electric motor furnishes power. Daylight opening is 11 in., table 16 x 10½ in. and throat opening 6 in. Machined flat sides of the unit and the absence of any projecting parts make it especially suited to gang type arrangement in minimum space. Among the accessories for the machine is one for automatic cycling in which a single lever affords the operator his choice of four automatic

actions. "Pressure reversal" is a feature of automatic cycling.

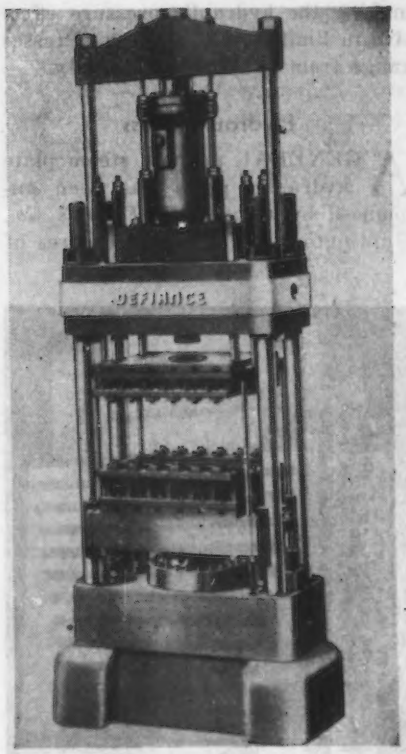


Toggle Drawing Press

A TOGGLE drawing press, the No. 3½-B, has been announced by *E. W. Bliss Co.*, Brooklyn 32, N. Y. Automatic operation is provided to handle coil brass or steel. The blankholder serves the dual purpose of blanking disks from the coiled strip and holding the blank for the drawing operation. The coil stock is fed through a seven-roll straightener to remove curvature, a precision double roll feed and a shear type scrap cutter. An automatic stock oiler is attached to the feed as stock lubrication is particularly desirable on drawing operations. The scrap cutter is furnished with spring holddown and edged tool steel blades. The incoming feed rolls and straightening unit are mounted on a vertical pivot so that they can be swung out of the way for the insertion of the dies.

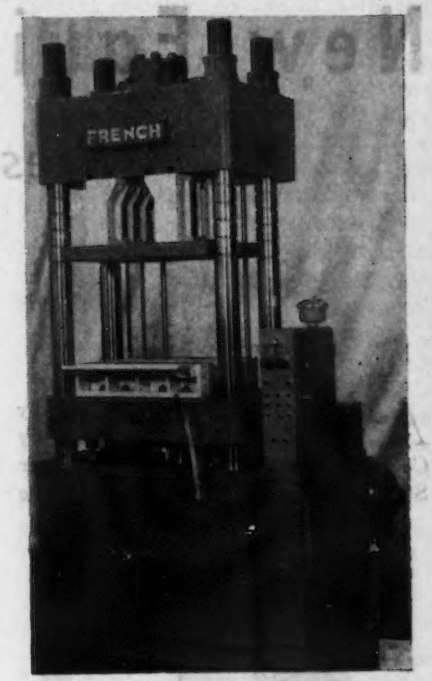
Plastic Transfer Molding Press

A PLASTIC transfer molding press, No. 152, has been announced by *Defiance Machine Works, Inc.*, Defiance, Ohio. Essentially an injection molding of thermosetting material, the mold charge is brought to a soft plastic condition in a chamber which is built into the machine and is separate from the mold. In this condition the material is then transferred or injected into the mold through a single opening. After the mold has been completely filled with the material, the application of heat and pressure is continued to permit complete cure or polymerization in the molded part. The press is double acting in principle, designed to operate from the accumulator system using pressures up to 3000 lb. per sq. in. There are three platens, the lower or main platen that moves upward, the intermediate or floating platen and the upper or stationary platen which is adjustable up or down in 2-in. increments. It has a maximum working pressure of 3000 psi and exerts a mold clamping pressure of 170 ton through the main ram, diameter 12 in. A transfer pressure of 42 ton (at 3000 lb. psi) is exerted through the transfer cylinder, diameter 6 in.



Plastic Molding Press

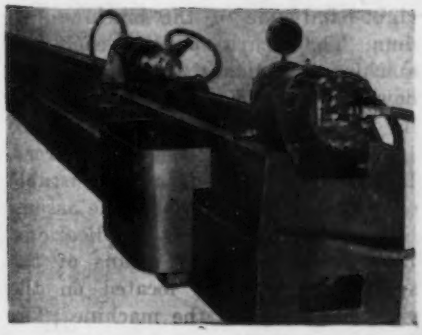
A MOLDING machine which is a combination compression and transfer molding press has been announced by *French Oil Mill Machinery Co.*, Piqua, Ohio. It is a self-contained unit with hydraulic pumping equipment built into the bed of the machine. Each unit contains a fully automatic cycle controller covering various types of molding. Timing intervals and changes from one type of molding to another can be changed and adjusted instantly. The presses are being used in connection with high frequency preheating units to obtain maximum production speeds. The idle closing speed is 300 in. per min. The 100-ton press is powered



with a 5-hp. motor and the 200-ton press with a 7½-hp. motor.

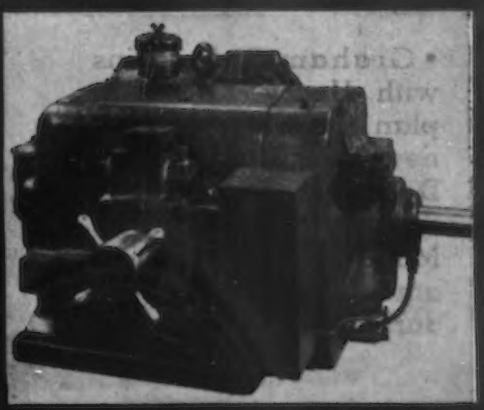
Hydraulic Stretch-Leveling Table

A HYDRAULIC stretch-leveling table, especially developed for permanently straightening and leveling narrow metal sections that are twisted, bent or otherwise distorted after rolling or heat treatment has been announced by *Rufford Machine Works, Inc.*, 207 N. Broadway, Redondo Beach, Cal. The machine handles sections up to 40 ft. in length of any shape and many materials. It not only straightens the stock by establishing a "set" in the metal through a slight predetermined stretching of the material but also can be used in conjunction with a die for stretching forming the workpiece to contours up to 30 deg. The machine has a pull capacity of 40 ton with a 19-in. stroke on each hydraulic piston but it can be built in higher or lower capacities to meet the varying requirements of straightening work. All control over straightening and stretch-forming operations is maintained at a central control panel.



OILGEAR

Oilgear Fluid Power units of this type are the heart of cordite extrusion press performance.



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5. Apply accurately variable pressure either static or in motion?
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12. Obtain accurately matched speed of various rotating elements?
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14. Obtain full preset automatic control, elimination of problems of shock, vibration, etc.?

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OILGEAR

Fluid Power

Assembly Line . . . STANLEY H. BRAMS

• Graham-Paige joins with Henry Kaiser to plan building of two new lines of cars . . . Detroit's attitude is somewhat skeptical . . . Mortality was highest among lower price cars during war years.

DETROIT—Skeptical interest is the way to describe the reaction of this automotive center to last week's announcement that Joseph W. Frazer and Graham-Paige Motors Corp. will join forces with Henry J. Kaiser to build two new automobiles, named after that pair of energetic gentlemen.

If Frazer proves himself as adept a manufacturer as he is a financier, Detroit could well erase its skepticism. During the past 15 months or so he pyramided a $500 investment in Warren City Mfg. Co. into a couple of million dollars in Graham-Paige stock, and now he has taken Graham-Paige and attached to it the magic of the Kaiser name and the interest—if not financial, at least paternal—of the Gianninis of the West Coast banking world. Obviously this is fabulous financing, grown almost entirely out of the Frazer personality.

But whether this personality can translate itself into mass manufacturing, even with the assistance of Kaiser, is something still to be proved. The automobile business is a peculiar, even unique industry. Frazer's lengthy background thus far has been purely on the administrative and sales side. Kaiser's unquestioned skill at putting ships together may not follow into automobiles; it achieved no outstanding success in aircraft, at Fleetwings.

But at the same time it should be noted that there already is a Kaiser car, in the lightweight class, to be built in what is planned as an ultimate network of plants extending out from Oakland, Calif. This Kaiser car will probably sell under $1000. Without any doubt it is at present rear-engined, powered by a 76 hp Continental especially engineered for its new location and shape. Plastic body sections are being considered as the means of continuing the light weight which characterized Kaiser's short-lived jeep program; magnesium and aluminum also are used in somewhat more than customary proportions.

The Frazer, to be produced at Graham's plant in Detroit, is in a somewhat more nebulous state of existence at this time. It may also have a Continental engine; perhaps the same engine that powers the Kaiser, amplified by two more cylinders at the end of the row, accompanied by a necessarily longer crankshaft, and probably turning up somewhere above 100 hp. This vehicle is thought of in the $1000-to-$1500 range.

Present plans call for unveiling both these cars sometime during the first quarter of 1946, perhaps shortly before, although this is somewhat doubtful. Ultimately it is hoped to manufacture the Kaiser and the Frazer at both plants. The Graham-Paige quota for 8000 vehicles during the rest of this year and 8000 more during the first quarter of 1946 will be used for both nameplates.

THE medium for manufacture of these vehicles will be the Kaiser-Frazer Corp., owned 50-50 by the Kaiser interest and Graham-Paige Motors Corp. Authorized capitalization is 5,000,000 shares of par $1 stock; paid-in capital at this time is only nominal. Kaiser is chairman of the board; Frazer is president and general manager. Directors include L. Boyd Hatch, executive vice president, Atlas Corp., New York; Oswald L. Johnston of Simpson, Thacher and Bartlett, New York; Walter Beinecke, president of John C. Paige & Co., Inc., New York; E. E. Trefethen, Jr., and George G. Sherwood of the Kaiser organization, and Robert L. Bridges of the legal firm of Thelen, Marrin, Johnson and Bridges, San Francisco.

In realigning Graham-Paige for resumption of passenger car production, Ray J. Hodgson, president since he was installed in 1942 by the RFC to protect the substantial loans of that time, has resigned. Frazer became president as well as chairman of the board.

Named as vice presidents are Vern R. Drum, vice president and general manager, and W. A. MacDonald, vice president in charge of sales. Drum, recently a president of Hupp Motor Car Co., has a manufacturing background at Willys and Chrysler; lately he has been vice president of Graham-Paige's subsidiary, Warren City Mfg. Co. MacDonald was assistant to Frazer when the latter was president of Willys.

Regardless of the skepticism which may exist in the informed circles of the automotive world, the man in the street who was buying Graham-Paige stock with the zeal of the Christian martyrs last week had the viewpoint that all the cars made in the next few years will be sold, and if Kaiser and Frazer make 'em, they'll sell 'em. And in this viewpoint the man in the street had some pretty good backing from a new report of R. L. Polk & Co., Detroit automotive statistical agency.

POLK reported that cars went off the road at a rate of more than 3365 per day between July 1, 1941, and July 1, 1944. This mortality of about 140 vehicles per hr was based on comparison of car registration of the two years, between which 3,585,089 passenger cars disappeared from the nation's highway.

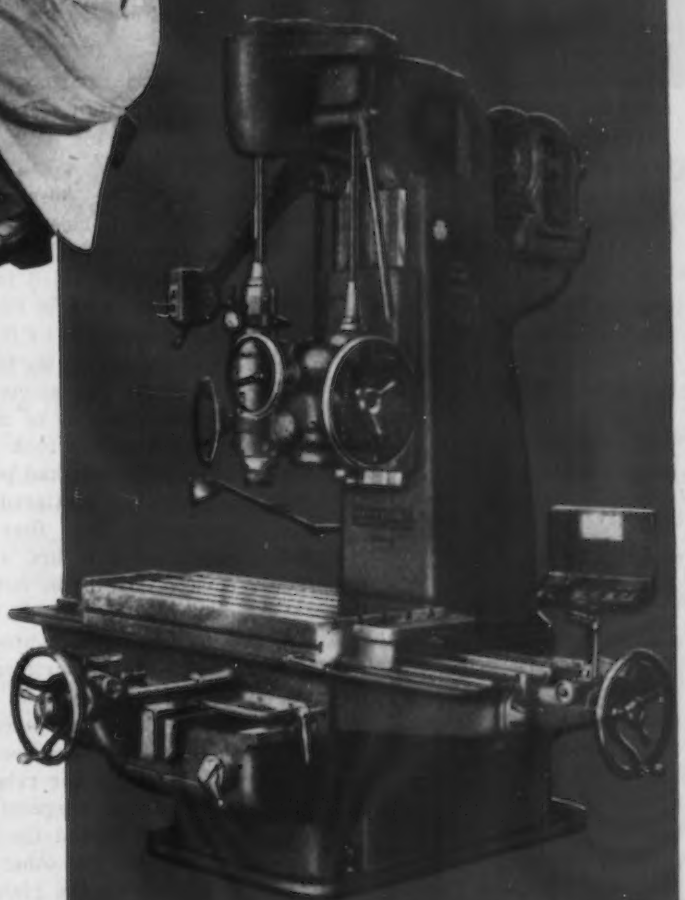
This 12.9 pct decline brought total U. S. car registrations as of July 1, 1944, down to 24,114,922 units, as compared with 27,700,011 in 1941.

More interesting than these figures, which were approximated earlier, was the breakdown of registration by makes. Chevrolet and Ford still show around twice as many registrations apiece as their nearest competitor, Plymouth.

The lowest price cars suffered the greatest losses in registrations during the war years, the report shows. Ford registrations, for example, dropped 18.8 pct, and Chevrolet's fell off 13.4 pct. Only two other makes, Nash and Chrysler, diminished more than ten

HIDDEN STRENGTH

This Picture Shows Another Reason Why a Pratt & Whitney Jig Borer Always Stays Put



Here's a view Pratt & Whitney customers seldom get. But it shows up a mighty important feature of the P&W Jig Borer — the web-like ribbing that is an integral part of the bed.

This machine carries a big load — column, table, carriage, and work — which it must support accurately in various positions. It is vital to precision boring that the machine *stay put*. That's the "why" of this unusual construction.

The ribbing is planned and designed to give the greatest support and stability exactly where the load requires it. It is one more example of the hidden quality that is responsible for Pratt & Whitney accuracy . . . one more reason why the performance of P&W Jig Borers is universally acclaimed.

Pratt & Whitney Jig Borer precision has "paid off" in producing the tools for war. These same machines, without change, will continue to "pay off" producing tools, jigs and fixtures for peacetime production. This machine is a "must" in every tool room. Ask us for literature.

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pct. On the other hand, there were actually more Mercury, Cadillac and Hudson cars registered last summer than there were in July, 1941, due to substantial stocks of these vehicles which filtered from dealer hands at the outset of war out into the registration stream. The accompanying table shows the breakdown of registrations by makes for 1941 and 1944.

G.M. Seeks to Modify Veterans' Seniority

Detroit

• • • New proposals on veterans' seniority, made by General Motors Corp. to the United Auto Workers Union of the CIO, differ in their details from the original positions of both parties. Several meetings have been held on the subject, and further sessions are expected.

The new General Motors position is designed to provide greater equity for both war veterans and for workers who have won their way onto the seniority list during the period from May, 1940, when the Selective Service Act became effective.

Under the new G. M. proposals, any honorably discharged veteran of World War II would be qualified for seniority in the company provided he had been in the service for more than two years or else served for any period in any theater of operations for which he is authorized to wear a theater campaign ribbon. He could be hired and displace any other employee whose seniority date is later than veteran's date of induction into service.

Originally, General Motors proposed that any honorably discharged veteran could displace any war worker coming on the job after May 1, 1940. The new proviso protects employees of the company up to the extent of their seniority, and also serves to eliminate from seniority provision any service men whose career in uniform consisted of short periods in training camps.

Other details of the plan provide that any disabled veteran could be hired by the company as it saw fit. All former GM employees now with military leaves of absence would be rehired in accordance with selective service provisions, which grant the employee added seniority equivalent to his time in service.

These proposals have been made not only to the UAW, but also to the United Electrical, Radio and Machine Workers Union of the CIO, which has a few scattered contracts. No reply has yet been heard from the UER.

Automobile Registrations by Makes

Make of Car	1944 Registrations	1941 Registrations
Chevrolet	6,079,937	7,017,237
Ford	5,536,418	6,814,386
Plymouth	3,041,222	3,328,477
Buick	1,542,725	1,665,984
Dodge	1,479,421	1,630,285
Pontiac	1,358,833	1,466,879
Oldsmobile	1,202,736	1,274,547
Chrysler	584,963	655,951
Studebaker	568,347	624,870
Packard	435,684	457,693
DeSoto	415,913	441,583
Nash-Ajax-Lafayette	392,298	453,457
Hudson	332,986	332,946
Mercury	228,664	198,187
Terraplane-Essex	189,896	312,637
Willys-Overland-Whippet	150,204	228,724
Cadillac	140,134	135,168
Lincoln	107,343	116,704
LaSalle	102,837	123,105
Graham	56,213	106,022
Hupmobile	23,450	67,614
Willys-Knight	6,032	19,068
Miscellaneous	138,686	228,487
Totals	24,114,922	27,700,011

Packard Protests UAW's Covering Overtime Notices

Detroit

• • • The possibility of a strike which would close Packard Motor Car Co. was the background this week to negotiations which followed company action last week in suspending its contract with the CIO United Auto Workers union on the grounds that the union was attempting to "usurp the prerogatives of management."

The company took its decisive step after notices it had posted which told workers in scattered bottleneck departments that they would temporarily work 48 hrs. a week had been covered by union notices telling the men to disregard the lengthened work-week. The union position was that if any departments went on 48-hr week all should.

The company, generally considered in Detroit to have been extremely liberal in its labor relations, then announced the suspension of the contract and barred the local president, Pat Zombo, and other top local union officials from the plant.

Negotiations followed between George T. Christopher, Packard President, and R. J. Thomas, International UAW President. The contract was then reinstated temporarily, Packard's position being that the union local would have to satisfy management that it was making permanent changes in its policy before complete reinstatement could be authorized. As far back as last spring Christopher has publicly complained over the increased difficulties in Packard labor relations since Zombo became the local union president late last fall.

GE Order Backlog Decreases 14 Pct

Schenectady

• • • Orders received by General Electric Co. during the first six months of this year amounted to $695,496,000 compared with $811,023,000 in the same period of 1944, a decrease of 14 pct according to Charles E. Wilson, president.

By quarters, the orders received have been as follows:

	1945	1944
First Quarter	$395,466,000	$391,901,000
Second Quarter	300,030,000	419,122,000
First Six Mos.	$695,496,000	$811,023,000

In pointing out that orders received for the second quarter of the year were 24 pct less than those for the first quarter, Mr. Wilson said: "The downward trend in orders may be expected to continue temporarily, possibly at an accelerated rate, as we enter another phase of the war. Our backlog, and, I think, that of industry generally, is still large and a temporary decline in orders need not cause any great dislocation if, simultaneously, industry is given the freedom to design and plan for new products to take up the slack as these backlogs disappear. The timing of this relaxation of controls is particularly important because on it depends the whole balance of our economy—the degree to which industry can provide jobs to keep up employment and turn out sufficient products to prevent runaway price levels."

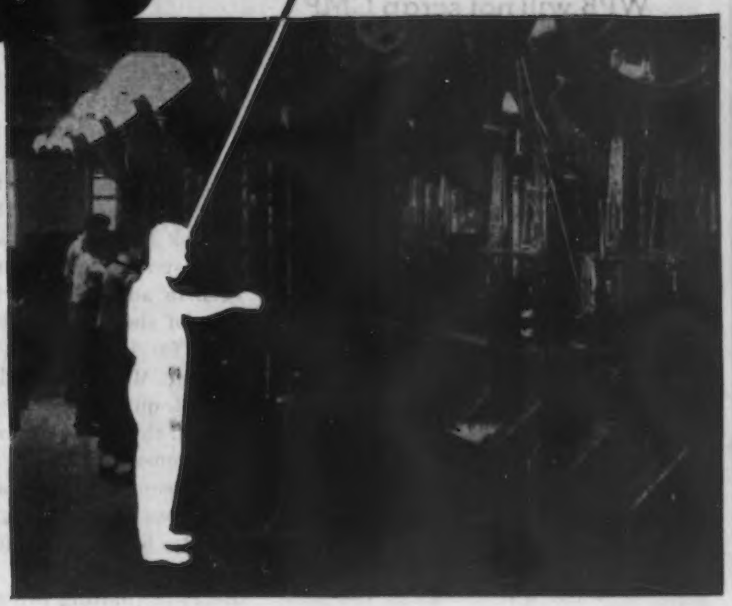
Goodrich Contracts Awaited

Cleveland, Ohio

• • • Contracts for construction of the new rubber research laboratory at Brecksville are to be awarded in about 90 days, officials of the B. F. Goodrich Co. said at Akron this week.

In the interim, seven houses on the 260-acre site acquired were being moved to new locations, while barns and outbuildings were being razed. When completed the laboratory is to cost "more than $1,000,000," company officials said, and will employ 100 professional and 110 non-professional workers, some of whom are already buying homes in the vicinity.

How many EXTRA MAN HOURS are your tools costing you?



Here's how to find out!

Men stand idle at machines every time a tool is reground or replaced. Time is wasted in the toolroom and in heat treating. But now there is a way to stop the costly loss from tools that wear too rapidly or fail prematurely. Use these three easy *job analysis* steps now.

1. Double Check Each Job At The Start!

Hundreds of Tool Engineers are using the Carpenter Matched Set Method to get tools that stay on the job longer. This method saves man-hours at machines, in the toolroom and in heat treating. In easy steps it shows which tool steel will give best results on each job. To put it to work on your jobs, ask for the Carpenter "Matched Tool Steel Manual". It is a 167-page book (Free in the U.S.A.) that will give you down-to-earth answers to your tooling problems.

2. Follow Up With Heat Treating "Know-How"

And here is your insurance that proper heat treatment will back up your work in designing and making tools. The Carpenter Heat Treating Guide is a handy slide chart that gives forging and normalizing heats, annealing and hardening treatments, recommended drawing ranges for all the Matched Tool Steels. Plus tips on quenching, drawing and furnace atmospheres. Use the new Heat Treating Guide to reduce down time, save man-hours and cut costs.

3. Check Each Tool On The Job!

How many pieces does each tool produce between grinds? Which tools fail too soon in service? Answers to those questions give you a yardstick to use in improving tool performance. And for personal help with your job analysis plan, call your nearby Carpenter representative. He knows tool steel from A to Z and can provide real engineering help. Get in touch with him for practical help on your jobs.

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Carpenter MATCHED TOOL STEELS

Washington . . . L. W. MOFFETT

• Indications are increasingly stronger that WPB will not scrap CMP earlier than Dec. 31 . . . Mr. Krug takes firm stand.

WASHINGTON — Indications are increasingly stronger that WPB will not scrap the Controlled Materials Plan earlier than Dec. 31 as originally planned.

In face of increased pressure brought to bear by factions both within industry and the WPB seeking to speed up adoption of the alphabetical rating pattern established by Priorities Regulation 29, Chairman J. A. Krug is reported to have taken the firm stand that in the interests of an orderly reconversion the "AA" priorities rating system together with existing materials controls should continue through the fourth quarter.

Arguments favoring earlier emancipation stress that with military orders covered by the "MM" band under PR-29, the residual quantities of steel could be disposed of on a more workable basis with the mills permitted to hand out civilian materials at their discretion during the fourth quarter. The flexibility of this system would, it is said, result in a production increase which would relieve the currently tight sheet and strip situation.

The more conservative element maintains that small business interests require continuance of the AA rating pattern to prevent a squeeze by the larger consumers in a scramble for whatever marginal quantities of steel are left after military requirements are satisfied. Furthermore, it is argued, the sheet and strip situation dictates retention of CMP until such a time as there are unquestionably sufficient quantities to satisfy both military and reconversion needs. Predictions are that noticeable improvement will be had in the fourth quarter from both the standpoint of decreased carryover and increased quantities of unrated steel. This improvement in the unrated steel outlook is held to be sufficient reason to assume that "open ending" will furnish adequate fourth quarter supplies of sheet and strip on an unrated basis for reconversion needs.

The CMP which will have rounded out 11 quarters of operation by the end of this year, replaced the "hunting license" era under the old Production Requirements Plan and precipitated one of the most extensive, yet orderly, bookkeeping jobs ever undertaken by industry. Based on the theory of limiting priorities authorizations to available supplies of controlled materials — steel, copper and aluminum—CMP which was first conceived as a "Budget Plan" and ultimately came to be recognized as the keystone of industry's conversion from peace to a wartime economy.

* * *

RECONDITIONING of Navy 40 mm ammunition boxes will save $800,000 within the next few months and as this program is expanded the savings are expected to run into millions of dollars.

Large quantities of these boxes were being returned by the Fleet to the shell loading plant operated by the United States Rubber Co., Charlotte, N. C., to be used again in the shipment of shells. Approximately one-third of the boxes received could not be used again because of the abuse they had received. As boxes were received at the plant they were inspected and segregated into three sections. Boxes in the first section were satisfactory for re-use in their present condition. Boxes in the second section were so badly abused they could not be economically reconditioned. The third section was made up of ammunition boxes that were badly weathered, requiring cleaning and refinishing or had mechanical defects of a nature that could be repaired or new parts installed economically.

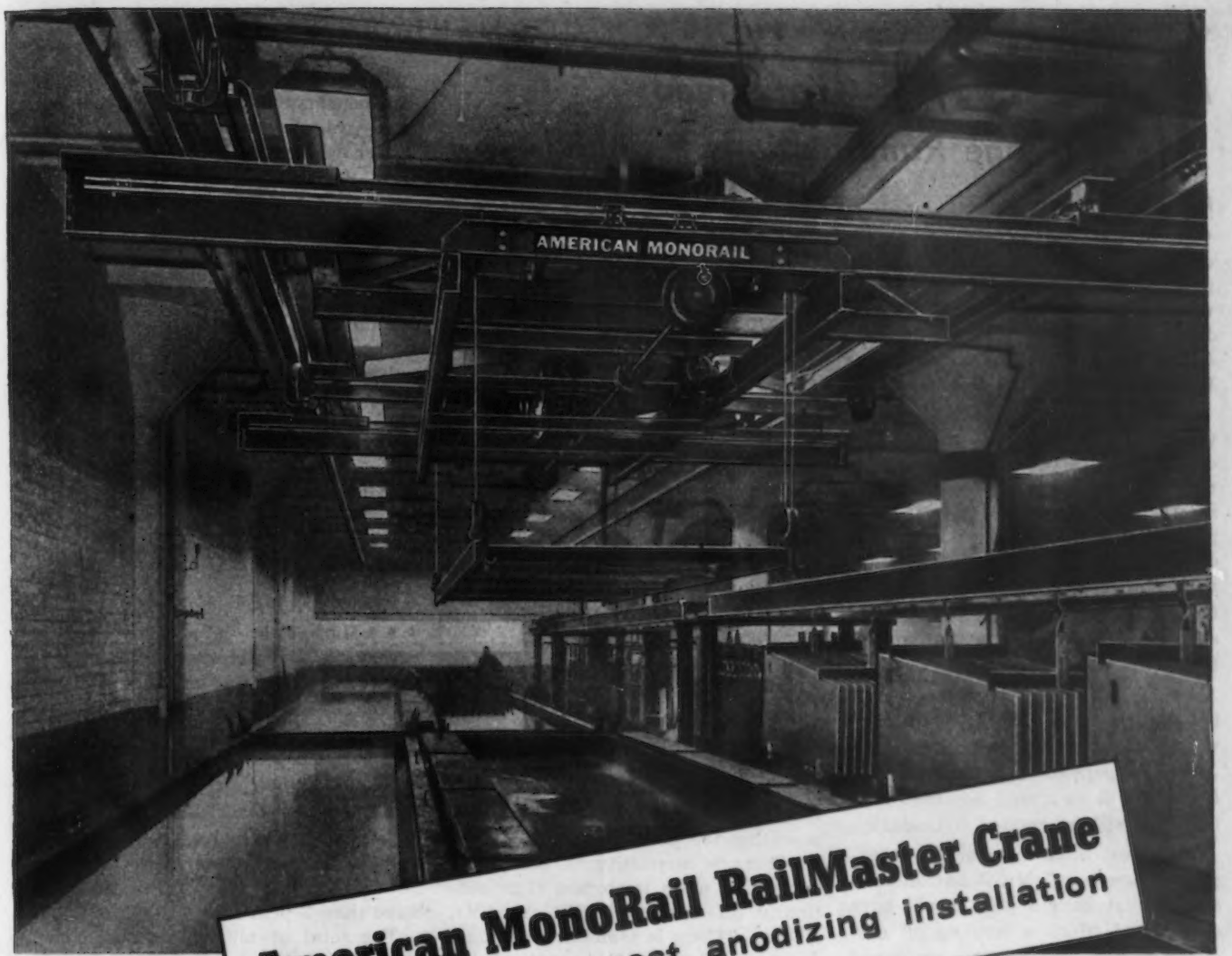
Of the last type mentioned there were approximately 200,000 on hand in Charlotte before the reconditioning program got underway. In order to achieve close supervision and inspection of the reconditioning operation and to minimize transportation, it was decided that it would be most practical to locate a plant within 100 miles of Charlotte. Since there were no facilities in the country that had ever done similar work, it was necessary for Lt. R. H. Sawyer, Field Officer, Industry Cooperation Division, OPM, to investigate all prospective plants personally and discuss the problem with them. A facility to do this reconditioning was required to have had experience in metal working, electric spot welding, metal cleaning and refinishing. Approximately 20 plants located within 100 miles of Charlotte were inspected by Lieutenant Sawyer.

From this group six firms were recommended and submitted firm bids to the Naval Inspector of Ordnance. Following the suggestions of Lieutenant Sawyer, the Bureau of Ordnance awarded contracts to the Truitt Mfg. Co., Greensboro, N. C., and Perley A. Thomas Car Works, Inc., High Point, N. C., for 100,000 ammunition boxes each, at a reconditioning cost of $1 per box. Since the new ammunition boxes cost in excess of $5 each this means a saving of $800,000 in the cost of new boxes as well as the conserving of materials and manhours necessary to make new boxes if these were not reconditioned. It is expected that many additional boxes located at other depots and being returned daily from the Fleet will be reconditioned by these two firms at a later date.

* * *

The Ford Motor Co. plant, located in the heart of the Antwerp dock area, which assembled more than 35,000 vehicles for American armies during the European campaign, will soon be processing about 400 crated vehicles a day for redeployment to the Far East.

The disassembling, processing and crating of these battle-used trucks and trailers, is being done by Belgian civilians under the supervision of Army Ordnance technicians.



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American MonoRail RailMaster Crane feeds nation's largest anodizing installation

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American MonoRail Railmaster Cranes of extremely simple design are developed for handling loads up to 5 tons by manual operation or propelled by rubber wheel drive.

With thousands of installations to draw from, American MonoRail Engineers are well qualified to offer solutions involving overhead handling equipment. Consultation with these men will reveal why American MonoRail equipment was selected to serve the nation's largest industrial plants. This service is offered without obligation — we invite your inquiry.

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Extensive Study of Guaranteed Annual Wage Ramifications Planned

Washington

• • • Plans for an extensive study of problems entailed in a system calling for a guaranteed annual wage were announced July 25 by Eric A. Johnston, Chairman of the Subcommittee of the War Mobilization and Reconversion Advisory Committee.

The study which was requested by the late President Roosevelt will be conducted on a conference basis with representatives of each industry and is intended to be an objective appraisal of the whole idea with due consideration being given to the economic approach, the problems and feasibilities confronting such a plan and the task involved in its administration, Mr. Johnston said.

Emphasizing that there now is not the slightest intention of invoking any wage plan on a compulsory basis, Mr. Johnston pointed out that no one formula will be found but that each industry will be treated individually.

"We must think in terms of an expanded economy," Mr. Johnston said, adding that such a plan would have a profound effect in leveling off economic cycles. He further expressed opposition to government financing any such plan if it could possibly be avoided.

"If feasible methods are proposed, industry is anxious wherever possible to maintain operations on a steady basis," Mr. Johnston said when asked whether industry would approach the idea with an open mind.

The survey which is expected to take from six to 18 months will be jointly conducted by Murray W. Latimer, Chairman of the Railroad Retirement Board and formerly professor at Harvard Business School and Arthur S. Meyer of Scarsdale, N. Y., Chairman of the New York State Board of Mediation and formerly member of the New York City Industrial Commission.

Members of the Subcommittee headed by Mr. Johnston who represents business include Philip Murray, president of CIO, representing labor, Albert Goss of the National Grange, representing agriculture and Anna Rosenberg, WMC Regional Director, representing the public.

"There is unanimity in that there is nothing more important than continuity of employment," said Mr. Meyer. "There is something we must do to avoid the full impact of the economic cycle."

A broader concept of those eligible for benefits under a guaranteed annual wage was advanced by Tom Silver who represented Mr. Murray. That, he said, would include all persons employed in a productive sense for a given wage and would include, as a conservative estimate, around 6,000,000 "white and blue collar workers." Mr. Silver pointed out that his organization did not consider this as a legislative problem but one to be solved through collective bargaining in each industry.

THE BULL OF THE WOODS — BY J. R. WILLIAMS

THE BULL O' TH' WOODS SNUCK OUT FER SOME GOLF TODAY-- GET AN EYE-FUL OF TH' GUY HE LEFT IN CHARGE!
YEAH, HE WAS AS-SISTANT FOREMAN FER THREE DAYS AN' TH' BULL TOLD HIM, "YOU'VE WATCHED ME LONG ENOUGH TO CATCH ON TO WHAT IT'S ALL ABOUT!"
TH' BULL SURE KNOWS HOW TO PICK 'EM--THIS FELLA HAS REALLY GOT TH' JOB DOWN PAT!
J.R.WILLIAMS
THE CLEVER UNDERSTUDY
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Construction Activity Shows Marked Gains In First Six Months

New York

• • • Marked by a pronounced recovery in privately-owned manufacturing building, construction activity in the 37 states east of the Rocky Mountains showed substantial gains in the first half of the year, according to F. W. Dodge Corp.

All major classifications of construction showed gains over the first half of last year except residential building, which was down slightly more than 3 pct.

The total of all construction contracts awarded in the 37 eastern states during the first six months was $1,482,399,000 compared to $960,221,000 in the corresponding period of last year, a gain of 54 pct, the Dodge corporation reported.

Nonresidential construction in the first half amounted to $807,612,000, an increase of 106 pct. Residential construction declined from $203,892,000 to $197,509,000. Public works and utilities totaled $477,278,000, an increase of 31 pct.

Manufacturing building construction contracts aggregated $515,806,000 in the first six months to establish a gain of 162 pct over last year's $197,077,000.

Continued improvement in the position of privately owned construction as compared with publicly owned construction was revealed by Dodge's tabulations.

Privately-owned construction contracts in the first six months totaled $573,491,000 compared to $243,543,000 in the corresponding period of last year. Privately-owned construction in the first six months represented 39 pct of the total of all contracts. It represented 25 pct of the total in the first half of 1944.

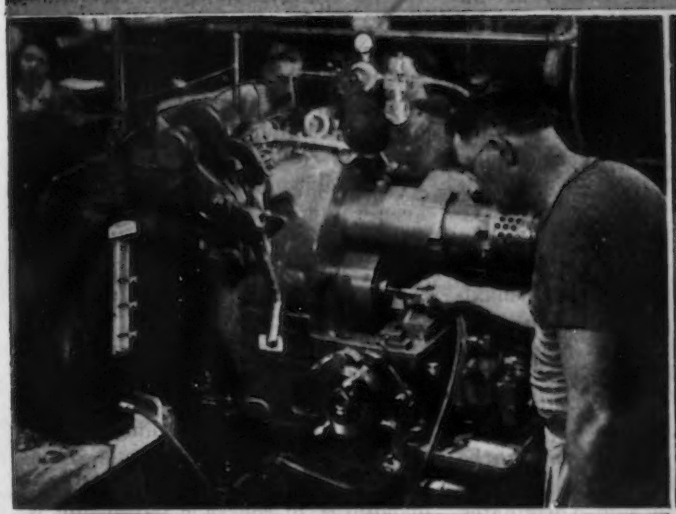
MODERN PROCESS CONTROL

Slashes Production Costs

Today's use of precision indicating instruments at the machines to check parts as they are being produced is a thrifty practice and results in slashing production costs. Inspection of each piece as it is made, with no extra time required, enables the operator to adjust the machine or tools before scrap is produced. Each operator produces a far higher percentage of acceptable parts—good parts which might previously have been improperly rejected are accepted—rejections are reduced—and the scrap pile, as such, is eliminated.

Time is saved on the assembly line because every part fits as it should — no subassemblies have to be torn down and reassembled. Salvage and rework time are practically eliminated. The completed product will be of higher quality, require less service and give more years of trouble-free performance.

Spending money for Sheffield Precisionaires, Visual Gages, Multicheks, Dial Indicator Snaps, Thredcheks, etc. . . . results in saving money by slashing production costs.



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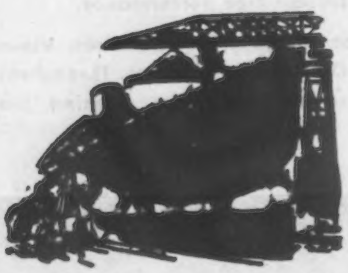
West Coast . . .

OSGOOD MURDOCK

• Far West feels Washington planned economists and political axe-grinders are stirring up regional and "monopoly" antagonisms to prejudice possibility for cheap steel, postwar jobs and continued aluminum industry.



SAN FRANCISCO—Plant disposal and the possible continued industrialization of the West continues to be perhaps the second most frequent topic of conversation in business circles here.

Breast-beating and tub-thumping expressions of highly vocal magnitude appearing to reflect strong regional prejudice, verging on provincialism, continue to recur in sufficient volume that they tend to obscure the basic issues involved. Due perhaps to local pride, as well as a tendency to develop a western "angle," the press devotes a good deal of space to the western aspects of current developments. Net result of this wholly understandable practice is to over-emphasize a minor phase.

The simple fact is that practically all interested policy-making bodies on the West Coast have gone on record with statements of complete impartiality as to who buys what. Incantations of social-political medicine men to the contrary, the average manufacturer in the West—assuming that he has thought about it all—wants cheap steel, and doesn't particularly care where it comes from. Prime consideration of the man-on-the-street is the question of jobs—how many and where—or to revert to Washingtonese, full-employment.

These two points appear to be the twin horns of the dilemma — if dilemma there be — on which public opinion is for the moment impaled. The Western States Council, organized chiefly to deal with this specific matter, has summed up the various attitudes of its subordinate groups. Its platform reflects the general attitude of business and more particularly, of the steel fabricators. In contra-distinction, expressions of policy emanating from Washington (with the exception of the newly appointed attorney-general's) seem to incite an intense sectional rivalry, if not downright antagonism. The point to bear in mind regarding this apparent rivalry is a geographic one—the source of the effluvium is not necessarily the Pacific Coast. A numerical count of date-lines shows that they emanate largely from Washington, D. C.

Capitol policy, epitomized by the statement of William Stuart Symington, new chairman of the Surplus Property Board, that "everything should be sold on the basis of maximum employment" illustrates the discrepancy in the regional points of view. Washington emphasizes maximum employment first and local ownership second. The West puts cheap steel first and employment second, saying "Give us the steel and we'll make the jobs."

Next point at issue appears to be the question of monopoly. The repeated use of this term also originates more in Washington than on the Coast. Until judicial opinion has definitely determined who and what constitutes a monopoly, the majority of the 6000 employees of the Columbia Steel Corp., U. S. Steel subsidiary, will probably continue to regard their company as the one that hands them their pay check every week. There will probably always be a certain number of people who will regard anything over $100,000 as big business and therefore monopolistic. But if this problem in semantics should also include the natural association of big business with "the interests" and therefore with Wall Street, the philosophy will run smack into trouble in Colorado, where the CF&I is regarded by many as a favorite son. And while still on the subject of monopoly, it is just barely conceivable that a voice from the back of the hall might be heard yelling, "What about a government financed 'WPA Steel Corp.' monopoly?"

Aside from the normal division of opinion on any given topic, the attitude of the West still appears to be best expressed by various steel committees representing metal working industry, which almost meticulously indicate that they hold no brief for any one of the three supposed parties at interest.

While the tenor of some of the press reports is still one of "The Battle for Western Steel still Rages," sight has been lost of the fact that all the basic issues involved in the steel question apply equally to disposition of the western aluminum industry.

NO condition of violent internecine warfare exists in this field—for the moment, and the analogy seems pertinent, so it may not be inappropriate to apply the leavening influence of the aluminum industry's attitude to the more flamboyant topic of steel. The Pacific Northwest is just as keenly interested in the disposition of their aluminum reduction plants and sheet mill as are they and the other western states in Geneva and Fontana.

One of the bodies most concerned is the Inland Empire Industrial Research, Inc., an organization formed by some of the most prominent industrialists at Spokane. Officials of this group say, "While the subject of plant disposal is, of course, a paramount issue, there are other problems of equal importance. Correction of these issues would do much toward an intelligent disposal of these plants. They are, specifically: 1, Inequality of freight rates; 2, the proper service of industry with low cost power; 3, the gradually widening wage scale differentials, particularly between the Middle West and the West."

According to best obtainable reports, both Aluminum Corp. of America and Reynolds Metals are interested in the Spokane sheet mill, and either of these "giants" would be fondly and unanimously clasped to the bosom of Northwest business if they offered continuous operation and integration of the Washington-Oregon aluminum industry without—again, at the moment—arousing any violent regional antagonism.

* * *

Substantial additional tonnage on military directives placed within the last two weeks has booked full pro-

Ties That Bind

Coast to coast, it's 2,500 miles. Border to border, it's about an even 1,000 miles. Yet—thanks to the man at the throttle and the vast empire he represents—these far-flung United States form one vast community . . . each part and parcel of the same package.

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If your product involves a question of power transmission and control, why not put it up to Twin Disc engineers? Their experience covers both "friction and hydraulics"... your assurance of unbiased recommendations as to the type of power link best suited to your job. TWIN DISC CLUTCH COMPANY, Racine, Wis. (Hydraulic Division, Rockford, Ill.).

SPECIALISTS IN INDUSTRIAL CLUTCHES SINCE 1918

duction plate tonnage at Geneva well into October. On commercial business Kaiser Co., Inc., is quoting from Fontana, October delivery on plates, November delivery on merchant mill products and October delivery on structural steel and forging quality blooms and billets. A substantial and increasing volume of commercial orders for California fabricator and warehouse customers is being supplied from Fontana, at competitive prices.

* * *

INTEREST rides high here in the Kaiser-Frazer automobile plans, and Kaiser car specifications may be released next month. Current speculation centers on whether the northern or southern part of the state will be the manufacturing site of the West Coast light-weight car. Odds appear to favor southern California, as the Norris Stamping Co. is apparently counted on by Mr. Kaiser. Kenneth B. Norris acknowledges that his existing facilities are suitable for automobile body forming. Collateral factors are the drift of auto assembly operations to the southern part of the state in prewar years, and the higher automobile sales and registrations.

With a registration of over 3 million cars in the state and 1941 sales figures showing over 60 pct of the market in the southland, Los Angeles chances appear good. Certainly many aircraft parts manufacturers could easily convert to automotive parts manufacturing.

* * *

Supplementing recent awards of barge contracts to Bay area shipyards, contracts have been awarded to Marinship, Kaiser yards Nos. 1 and 2, Calship at Wilmington and the Kaiser yards at Portland, Ore., for the construction for Navy of a large number of additional steel barges "of unusual size." Kaiser Richmond will start rehiring all crafts, and the two yards will operate at full capacity.

The Navy is purchasing all available plate from surplus Coast stock to speed initial operations. The balance, over 100,000 tons, is to be divided between Geneva, Fontana, other Coast mills and eastern sources for heavy structurals.

* * *

No early dissolution of the WLB appears in sight as the shift in some industries starts toward reconversion. William Hearn, executive assistant to industry members of the 10th Region WLB, last week told members of the California Metal Trades Assn., "There must be a balance maintained between wages and the cost of goods bought. Thus, as long as you have the OPA you will need the WLB."

* * *

LOS ANGELES—Kaiser Co., Inc., at Fontana has just purchased eight pieces of iron ore property from the Colorado Fuel & Iron Co., adjacent to the Vulcan deposits from which Fontana has been getting its ore in San Bernardino County. Price was reported as $125,000.

The Byron Jackson Co. is planning a $1,500,000 expansion program to accommodate backed-up demand for consumer products and addition to its line of new products. Two new plants will be built, one adjoining the company's plant at Los Angeles and the other adjoining its Houston, Texas, plant.

* * *

Dresser Industries, Inc., Cleveland, Ohio, continues to add to its portfolio of California operations by acquiring the Security Engineering Co., Inc., of Whittier, manufacturers of oil well drilling equipment.

* * *

Oil Well Supply Co., subsidiary of the U. S. Steel Corp., is exercising its option to purchase the Neilson Pump Co., at Long Beach.

* * *

The 10th Regional WLB has recommended and will hold a hearing on a proposed wage increase for certain categories in the metal trades field. Recommendations propose to raise journeymen sheet metal workers from $1.25 to $1.50 an hr, job shop pattern makers from $1.60 to $1.80, and heavy forge blacksmiths working hammers over 3000 pounds from $1.50 to $1.75 an hr.

Scientific Research Seen Making Great Strides in Russia

Schenectady

• • • **Basic scientific research** in Russia is rapidly progressing under the direct support and enthusiastic promotion of the Soviet government, according to Dr. Irving Langmuir, associate director of the General Electric research laboratory who has returned from an international science conclave sponsored by the Soviet Union to celebrate the 220th birthday of its Academy of Science.

"Russian researchers do not undertake as many new scientific problems as private laboratories here, but the amazing amount of interest and direct support accorded them by government leaders is stimulating a rapid scientific development," he pointed out.

One of 17 prominent American scientists attending the anniversary as guests of the Soviet, Dr. Langmuir, spent 18 days in Moscow and Leningrad visiting the Institute of Physical Chemistry, the Institute for Physical Problems, and many other laboratories.

Intensive research on a few basic problems, rather than extensive work on many general problems, is the characteristic trend of present Russian science, he observed. Some of their intensive study has been on plastics, behavior of hydrocarbons during combustion, and various chemical reactions of explosives.

"Russian scientists are urged to study the various aspects of basic science under the direction of laboratory heads similar to those we have in private research companies here," Dr. Langmuir said. "The Soviet government has granted fundamental science the highest priorities on equipment, materials, and incentives."

Attributing much of Russia's scientific progress to the effective incentive system, Dr. Langmuir explained that important people, including the leading scientists, are paid with extra ration allowances as well as money. These additional rations permit the purchase of more and better food, furniture, clothing, and homes. Since rationed goods are sold at prewar prices, and unrationed goods have a surtax often amounting to about 99 pct, money is of little importance in the present economy, he said.

"If the United States undertook a like plan of subsidizing science without adopting an effective incentive plan, progress would be retarded," Dr. Langmuir stated. "Such a plan as the Russians have would probably not work here because most Americans would resent the great disparity between rewards given skilled or educated technicians and those given common laborers."

Living conditions in Russia are still low by our standards, as new clothing, building materials for reconstruction, and luxuries are almost nonexistent, but food is sufficient for all and the government expects standards to rise rapidly above prewar levels, Dr. Langmuir said.

HYDRAULIC BALANCE

CANCELS OUT BEARING LOADS

And Means MUCH LONGER PUMP LIFE

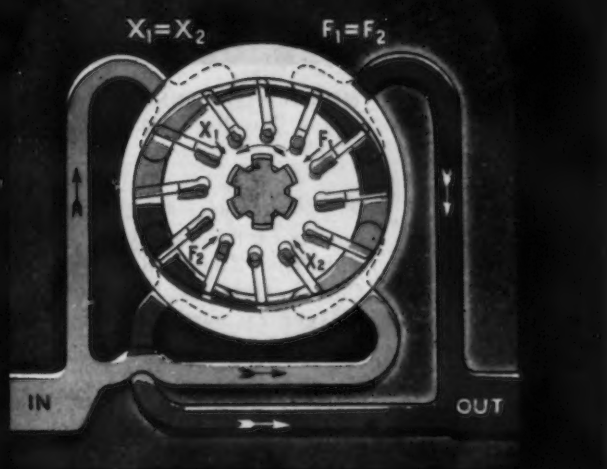

Diagram showing patented "Hydraulic Balance" construction.

VICKERS

Balanced

VANE TYPE PUMPS

As illustrated by the diagram above, equal and opposing pressure areas are provided on the outlet side and on the inlet side of Vickers Balanced Vane Type Pumps. The equal and opposing radial hydraulic thrust loads cancel each other . . . consequently there are *no* bearing loads resulting from pressure. The major cause for wear is thus completely eliminated and the result is much longer pump life. This "Hydraulic Balance" construction is exclusive with Vickers Vane Type Pumps; it also permits an unusual design compactness and is an important reason for the exceptionally high efficiency of these pumps.

Vickers Balanced Vane Type Pumps are available in single-stage for 1000 psi (see Bulletin 40-25a); two-stage for 2000 psi (see Bulletin 40-16) and also two-pressure, large-small volume (see Bulletin 38-14). Vickers Application Engineers will gladly discuss with you the many different types of hydraulic power and control circuits on which these pumps have improved machine performance. Write the office nearest you.

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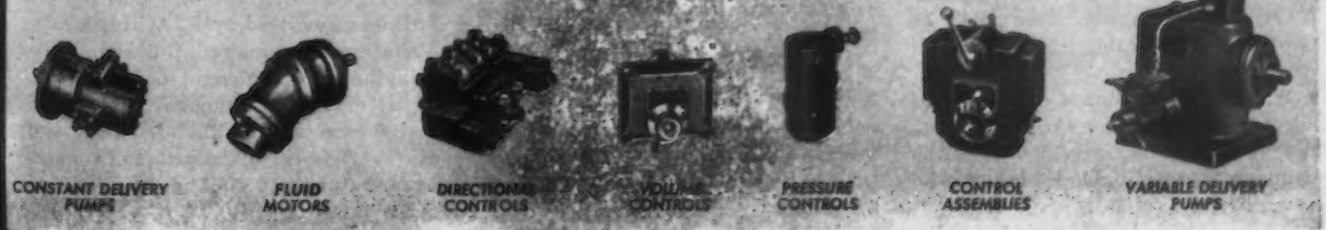


PERSONALS

FRANK J. OLIVER, editor, *Electrical Manufacturing.*

HORACE E. LINSLEY, technical editor, THE IRON AGE.

• **Frank J. Oliver,** technical editor of THE IRON AGE, has resigned to join the Gage Publishing Co., New York, as editor of *Electrical Manufacturing.* **Horace E. Linsley,** formerly technical-public relations supervisor at Wright Aeronautical Corp., Paterson, N. J., has succeeded Mr. Oliver as technical editor of THE IRON AGE.

• **F. M. Gunn,** works manager of the Chicago plants of Pullman-Standard Car Mfg. Co., has been named assistant to the president of the company. He will be succeeded by **H. B. Reed,** assistant works manager, Chicago plants.

• **Fred E. Harrell,** chief engineer, Reliance Electric & Engineering Co., Cleveland, has been appointed general works manager. He has been succeeded by **William R. Hough,** product development engineer.

• **L. J. Wise** has been appointed general manager, Allied Steel Casting Co., Chicago. **Harold G. Evans** has been named works manager and **William Harrison,** plant superintendent.

• **Ray E. Valentine** has been appointed St. Louis office sales agent for National Malleable & Steel Castings Co., Cleveland. Mr. Valentine, who has been with National Malleable since 1912, has been serving with WPB in Washington since 1943 as chief of the malleable iron section.

• **W. Howard Williams,** a founder of the Clark Controller Co., Cleveland, has been elected president of the company, succeeding **J. J. Mellon,** who has resigned.

• **L. B. Robertson,** general superintendent at Wisconsin Steel Co., Chicago, since 1936 has retired. He has been replaced by **William E. Brewster,** assistant general superintendent since 1936. **Roy A. Lindgren,** formerly second assistant, has become assistant general superintendent.

• **W. S. Dawson** has been elected first vice-president and general manager of the Romec Pump Co., Elyria, Ohio, following the resignation of **H. B. Stecher** as president. Mr. Dawson has been succeeded as manager of the Cleveland Steel Products Co. plant at Wellington, Ohio, by **V. J. Peterson.**

• **W. O. Bates, Jr.,** vice-president of Caterpillar Tractor Co., Peoria, Ill., has been appointed manager of the company's facilities at San Leandro, Calif. He formerly divided his time between these operations and the military engine plant at Decatur, Ill.

• **John E. Ohlson,** formerly with Wyeth, Inc., Philadelphia, has been appointed senior chemical engineer of the Pennsylvania Salt Mfg. Co., Philadelphia.

• **C. W. Guyatt,** formerly chief industrial engineer, American Steel & Wire Co., Cleveland, has been appointed assistant to C. D. King, chairman of operating committees, United States Steel Corp. of Delaware, Pittsburgh.

• **G. T. Johnson** has been elected president and general manager, Buckeye Steel Castings Co., Columbus, Ohio, succeeding **A. H. Thomas** who has been named chairman of the board. **Frank H. Bonnet** has been appointed first vice-president and **W. J. Bennett,** secretary and treasurer.

• **Dr. Wendell P. Metzner** has been transferred to Monsanto Chemical Co.'s central research laboratories in Dayton, where he will head the flexible type high polymer group. He has been succeeded in the organic chemicals laboratories by **Harold L. Hubbard.**

• **Sidney E. Johnson** has been appointed southern regional manager in the sales department of the manufacturing division, The Crosley Corp., Cincinnati.

• **Gilbert Soler,** superintendent of the quality control departments at Steel & Tube Div., Timken Roller Bearing Co., Canton, Ohio, has been named assistant general superintendent of the division.

• **S. J. Mergenhagen** has joined the Pittsburgh sales organization of Heppenstall Co., Pittsburgh.

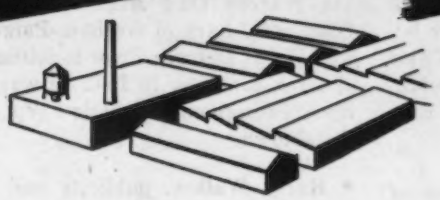
• **Edward H. Schoonmaker** has been appointed sales engineer for the Southwestern district office of the Baldwin Locomotive Works, Eddystone, Pa.

• **Ray Newman** has been named assistant resident manager of the Kansas City plant of Fisher Body Div., General Motors Corp., Detroit. Mr. Newman has been since 1942 general shift superintendent at the Fisher Memphis plant.

• **A. C. Fellinger** has been appointed sales manager, power transmission machinery, Link-Belt Co., Chicago, succeeding the late **C. Walter Spalding.** His headquarters will be at the company's Ewart, Indianapolis, plant. Sale and application of Link-Belt silent chain drives will be headed by **H. F. R. Weber,** divisional sales manager, with headquarters at the Ewart plant. Sales af the ball and roller bearing division through distributors will be supervised by **F. A. Hurd,** divisional sales manager, industrial distributor sales, Chicago; **G. H. Unruh,** divisional sales manager, industrial distributor sales, Philadelphia; and **Harry Reisser,** divisional sales manager, automotive equipment sales, Indianapolis.

This Complete Pumping Unit

Is Built!



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Here's what that means to you. **In addition to sustained high efficiency pumping equipment—with its operation designed to do your particular job—you get three major advantages from Fairbanks-Morse Complete Pumping Units.**

1. **Combined Responsibility.** Designed and built in one factory, pump and driver (motor or engine) are perfectly matched and covered by a single guarantee.
2. **Successful UNIT Performance.** Tested in one plant under expert engineering supervision, pumps and drivers assure you superior operation.
3. **Service from ONE Source.** One engineer is familiar with the entire installation—no question as to who makes any adjustments or repairs.

You get these major advantages from Fairbanks-Morse . . . because only Fairbanks-Morse designs and builds all components of an outstanding line of complete pumping units.

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Diesel Locomotives • Diesel Engines • Generators • Motors • Pumps • Scales
Magnetos • Stokers • Railroad Motor Cars and Standpipes • Farm Equipment

J. R. TOWNSEND, president, American Society for Testing Materials.

RICHARD O. LOENGARD, president, United Chromium, Inc.

CARL E. ANDERSON, director of industrial relations, Warren City Mfg. Co.

• **J. R. Townsend,** materials engineer, Bell Telephone Laboratories, Inc., New York, has been elected president of the American Society for Testing Materials for 1944-45; **T. A. Boyd,** Research Laboratories Div., General Motors Corp., Detroit, has become vice-president. Executive Committee members elected are **John R. Freeman, Jr.,** technical manager, American Brass Co., Waterbury, Conn.; **L. J. Markwardt,** assistant director, U. S. Forest Products Laboratory, Madison, Wis.; **Carlton H. Rose,** chemist, National Lead Co., Brooklyn; **L. P. Spalding,** chief research engineer, North American Aviation, Inc., Inglewood, Calif., and **William A. Zinzow,** chief physicist, Bakelite Corp., Bloomfield, N. J.

• **Richard Righter** has been appointed manager, sales personnel and training, Carnegie-Illinois Steel Corp., Pittsburgh.

• **J. J. Anderson** has been appointed assistant service manager of the Electric Appliance Div., Westinghouse Electric Corp., Mansfield, Ohio.

• **Howard A. Darrin,** who helped design the Packard Clipper and the Lincoln Continental, has been engaged as a consultant for the design of postwar automobiles of Graham-Paige Motors Corp., Detroit.

• **Brig. Gen. Isaac W. Ott** has been named chief of the Air Technical Service Command maintenance division, ATSC headquarters at Wright Field, Dayton. Gen. Ott replaces **Maj. Gen. Victor E. Bertrandias,** recently assigned to duty overseas.

• **Richard O. Loengard** has been appointed president of United Chromium, Inc., New York, and **Theodore G. Coyle** and **Hugh D. McLeese** have become vice-presidents. Messrs. Coyle and McLeese will continue as technical director and general sales manager, respectively.

• **S. H. Standish,** general manager of the G. H. R. Foundry Div., The Dayton Malleable Iron Co., Dayton, has been named vice-president in charge of engineering. **W. J. MacNeill** has been appointed to succeed Mr. Standish as general manager of the Foundry Div. Mr. MacNeill recently resigned as president of the Federal Malleable Iron Co., West Allis, Wis.

• **Kirtland C. Gardner, Jr.** has been appointed assistant to the general manager, United Engineering & Foundry Co., Pittsburgh. **Alfred R. Kruse** has been made manager of the proposal department, and **W. W. Lusk,** sales engineer of the machinery sales department.

• **Carl E. Anderson** has been appointed director of industrial relations at the Warren City Mfg. Co., Warren, Ohio, subsidiary of Graham-Paige Motors Corp., Detroit. Prior to joining the Warren company in 1942 he was with the Westinghouse Electric Corp., East Pittsburgh.

• **Harry Walker,** publicity and sales promotion man for the Baldwin Locomotive Works, Eddystone, Pa., has resigned to return to Denver.

• **Frank H. Gordon,** vice-president in charge of sales, has completed 50 years of continuous service with Lukens Steel Co., Coatesville, Pa.

• **R. W. Hubbard** has been appointed export product manager of the export division, Crosley Corp., Cincinnati.

• **John C. Sykora** has been elected vice-president and director of sales for all divisions of the Portable Products Corp., Pittsburgh. He will direct activities from newly established headquarters in New York City.

OBITUARY...

• **Victor A. Jevon,** assistant manager of sales in charge of Pittsburgh district sales for Jones & Laughlin Steel Corp., Pittsburgh, died July 18. Mr. Jevon had been with J&L since April 1938. Prior to that time he had been with the Bethlehem Steel Co.

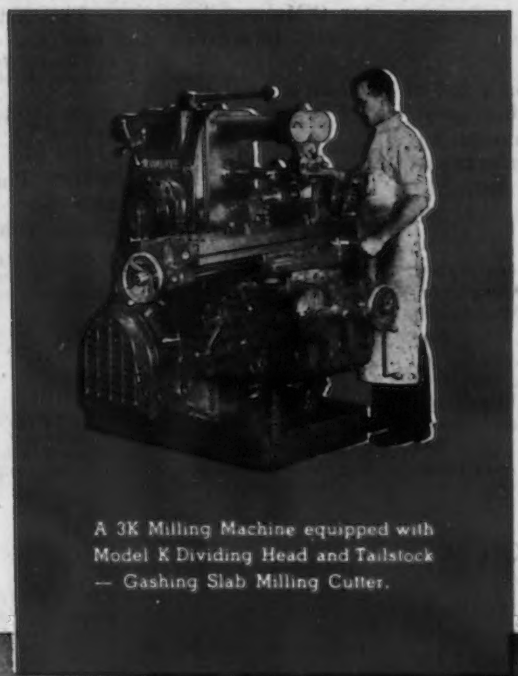
• **Roy R. Gibson,** manager, automotive replacement sales, Johnson Bronze Co., New Castle, Pa., died July 17.

• **Charles H. Aldrich,** technical consultant and superintendent for the U. S. Metals Refining Co., New York, with which he was associated for 22 years, and an authority in the field of smelting and refining, died July 20. He was 66 years old.

• **Charles S. Robinson,** 81, retired vice-president of Youngstown Sheet & Tube Co., Youngstown, Ohio, died recently. Mr. Robinson was active during the company's expansion period and from 1906 until 1939 was a leader in sheet and tubes expansion.

WHEN MILLING HAS TO BE DONE WITH SPEED, PRECISION, PROFIT

PUT IT ON A *Milwaukee*

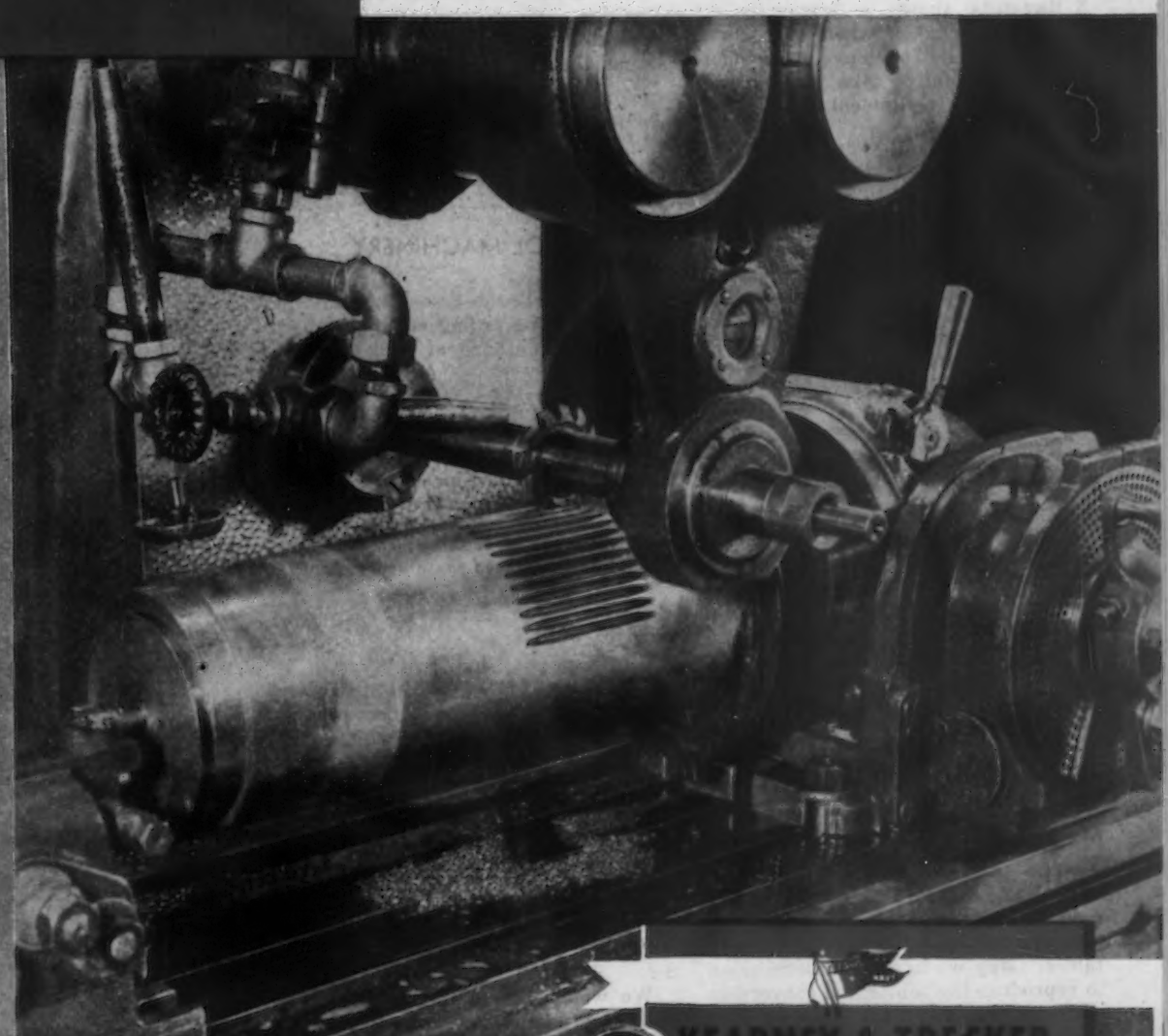


A 3K Milling Machine equipped with Model K Dividing Head and Tailstock — Gashing Slab Milling Cutter.

In tool-room or laboratory — on the production line — wherever milling has to be done — simple routine job or "tricky" operation — put it on a Milwaukee! Experienced machine-shop men prefer to use a Milwaukee when it is available because they know that's the way to get the work done — with speed, precision, profit.

Time-tested, production-proved, modern in every detail of design and construction but free of untried features, Milwaukee Milling Machines yield the sustained performance — with precision and speed — that spell profit in milling operations.

Write for new Bulletin K10 giving detailed and descriptive information on Model 2K and 3K Milwaukee Milling Machines.



Milling a worm gear in a spindle quill on a 3K Universal Milling Machine. Angular 7° spacing of cut is indexed with less than one turn of the index handle on the Model K Dividing Head.

Milwaukee Machine Tools

KEARNEY & TRECKER CORPORATION

MILWAUKEE 14, WISCONSIN

Dear Editor:

SINTERING

Sir:

As we are making a study of various sintering processes we would appreciate knowing which of the processes are most commonly used by domestic mills.

A. BOHLER
Amerlux Steel Products Corp.,
551 Fifth Ave., New York 17

● The most common process is the Dwight & Lloyd procedure. A number of Greenawalt machines have been installed but their proportion is only very minor compared to the Dwight & Lloyd installations. The Rotary Kiln project for nodulizing is attracting considerable interest. So far as we know, however, no units have been installed.—Ed.

SHOCKPROOF X-RAY TUBE

Sir:

Your caption of a photograph in the June 14 issue states that the portable X-Ray tube shown is "obviously not held in the hands when energized." This fact is not obvious to our operators who daily take radiographs using similar equipment held in the hands.

D. E. DAWSON,
Process Engineer
North American Aviation, Inc.,
Inglewood, Calif.

● Illustration in question was obviously posed; the girl would not hold an energized X-Ray tube in the manner shown therein. While it is general practice to clamp the tube against the section under examination, it is feasible to hold such a shockproof tube in the hands where protective gloves, gowns, and helmets are employed to shut off X-radiation.—Ed.

STAINLESS PRODUCTION

Sir:

Are reliable figures or estimates for total stainless steel production for 1944 yet available, with breakdowns into basic forms?

ROLFE POTTBERG
Tainton Products, Ltd.,
Baltimore 11

● Publication of the figures is expected in the very near future in the 1944 edition of the Annual Statistical Report of the American Iron and Steel Institute.—Ed.

MULTIPLE SPINDLE DRILLING

Sir:

We are producing a new engineer's manual, and in the metal working section are incorporating various useful tables. May we have your permission to reproduce the tables and conversion chart in the May 31st issue of THE IRON AGE on "Time Allowances for Multiple Spindle Drilling"?

C. P. GREEN,
Industrial Products Department
Sun Oil Co.,
Philadelphia 3

● Permission granted.—Ed.

PERFORATING METAL

Sir:

Would you please send us a list of manufacturers of perforating presses? Also, can you recommend any good books pertaining to perforating?

F. J. MUETH
Aluminum and Architectural Metals Co.,
Detroit 7

● List of manufacturers has been mailed. "Punches, Dies, and Tools for Manufacturing in Presses", by Joseph V. Woodworth, Norman W. Henley Publishing Co., New York; "Pressworking of Metals", by C. W. Hinman, McGraw-Hill Book Co., Inc., New York; and "Plastic Working of Metals and Non-Metallic Materials in Presses", by E. V. Crane, John Wiley & Sons, Inc., New York, may also furnish valuable references. —Ed.

REYNOLDS ORGANIZATION

Sir:

The article "Reynolds Strengthens Position of Organization" is of special interest to me in the work I am doing. Is a reprint available?

L. V. REESE,
Advisory Engineer
Reconstruction Finance Corp.,
Arlington, Va.

● Tear Sheet mailed.—Ed.

STEEL WOOL MACHINERY

Sir:

We would be interested in obtaining information regarding machinery used for fabrication of steel wool.

G. W. McMASTER
J. L. Demers, Ltd.,
Levis, P. Q., Canada

● As far as we know there is no standard machinery on the market here for making steel wool. The dozen steel wool manufacturers in this country use their own specially built machinery. E. W. Bliss & Co., Brooklyn, some years ago made some such machinery, but later discontinued the practice.—Ed.

JAP MAP

Sir:

We are enclosing 25c in stamps to cover cost of your map on Japan's war plants which appeared in the World-Telegram on July 2.

FRED O. NEWMAN,
News Editor
Popular Science,
353 Fourth Ave., New York 10

● Map has been forwarded.—Ed.

SWEDISH STEEL

Sir:

We would greatly appreciate it if you would kindly favor us with a copy of the article "Coke Supply Seen as Key to Sweden's Steel Output," in the Mar. 15 issue.

A. T. BARNETT
Sandvik Canadian, Ltd.,
426 McGill St., Montreal 1

● Tear sheets mailed.—Ed.

WESTERN STEEL DISPOSAL

Sir:

Please send me six reprints of Senator O'Mahoney's report. This article is very interesting and useful.

C. H. WITTENBERG,
Manager, Southern Division
Columbia Steel Co.,
Los Angeles

Sir:

Send me the Iron and Steel Plants Disposal Report prepared for the Senate Committe on Military Affairs.

M. D. HARBAUGH,
Vice President & Secretary
Lake Superior Iron Ore Association,
Hanna Bldg., Cleveland

Sir:

Please send a reprint . . .

FRED H. STERNS,
Industrial Surveys and Population Studies
American Telephone & Telegraph Co.,
195 Broadway, New York 7

Sir:

Herewith 10c for a copy . . .

F. M. HESSE,
Vice President
National Steel Corp.,
Grant Bldg., Pittsburgh

Sir:

Please send me a reprint . . .

R. L. BALDWIN,
Sales Development Manager, Electrode Products
National Carbon Co., Inc.,
Niagara Falls, N. Y.

Sir:

Please send me a reprint . . .

WARD A. MILLER,
Vice President
Vanadium Corp. of America,
Graybar Bldg., New York 17

Sir:

I would appreciate two copies . . .

E. H. GUMBART,
Manager of Sales
Bethlehem Steel Co.,
Union Trust Bldg., Cincinnati 2

Sir:

I shall appreciate 12 copies . . .

HAROLD J. RUTTENBERG,
Research Director
United Steelworkers of America,
Commonwealth Bldg., Pittsburgh 22

Sir:

Please send five copies . . .

W. McK. GREEN,
Assistant Manager
Cleveland-Cliffs Iron Co.,
Union Commerce Bldg., Cleveland 14

Sir:

Please send ten copies . . .

D. S. KLIPPERT,
Assistant General Manager of Sales
Timken Roller Bearing Co.,
Canton 6, Ohio

Sir:

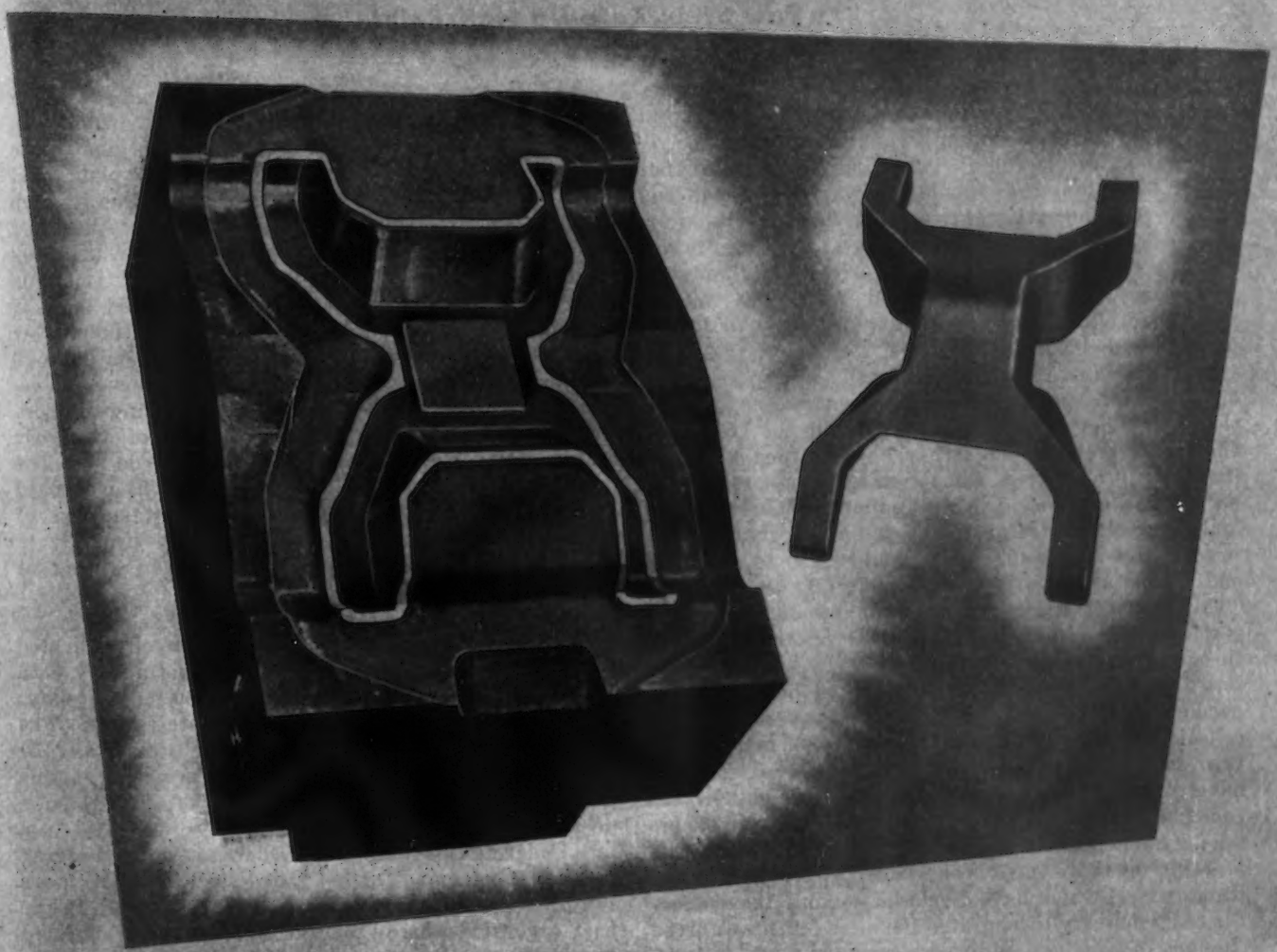
Would you forward me the copy of Iron and Steel Plants Disposal Report?

J. B. EDWARDS,
Assistant to Superintendent, Major Alloy
Electro Metallurgical Co.,
Niagara Falls, N. Y.

● Reprints mailed.—Ed.

T & W FORGINGS

Usually Cost Less at the Point of Assembly



● **Time is a vital cost factor in the use of any material. Time makes an important difference in the cost of forgings at the point of assembly — *a difference that may be reflected in your selling cost.***

T & W forgings are formed to close tolerances and usually require less machining and finishing time, which makes them cost *less at the point of assembly*. Ask a T & W Forging Engineer how to be sure of obtaining this difference in the cost of forgings.

TRANSUE & WILLIAMS

STEEL FORGING CORPORATION • ALLIANCE, O.

SALES OFFICES: NEW YORK, PHILADELPHIA, CHICAGO, INDIANAPOLIS, DETROIT AND CLEVELAND

This Industrial Week . . .

- ***Steel Mills Make Alternate Schedules***
- ***Nonrated Order Volume Is Higher***
- ***Raw Steel Rate Up Half Point***

THERE was little in the steel market this week to encourage civilian manufacturers to expect early delivery on items which would start the reconversion wheels rolling at a reasonable speed, but there were signs that should the war with Japan end sooner than now thought, steel mills would be in a good position to take full advantage of such an event. For the time being at least deliveries to civilian steel users are in no better position than they were a month ago. Rated steel orders are still heavy and backlogs on such business are large.

However in the past week many of the reluctant civilian steel consumers have become tired standing on the order sidelines and have stepped up the volume of their orders even though they have no idea when deliveries will be made. Among such consumers are the automobile group and home appliance makers. They and many other steel users are taking no chances now in case the war with Japan should come to a sudden end. Nor are they planning definitely that it will. They are just being cautious and remembering historically that those who place their orders first have the greatest chance to benefit.

Just as steel users with nonrated business have awakened to the fact that heavy and severe war cancellations would greatly change the steel market picture so have steel producers themselves. The latter have set up so-called precautionary schedules that could be quickly put into operation should war events take a sudden turn for an ending. Even while this is going on there have been sudden spurts in demand for war steel which have displaced not only the chances for early delivery of nonrated business but have forced changes in schedules for orders carrying CMP ratings.

The net result of these general market trends reflects a waiting game on the basis that, if the war lasts longer than supposed, orders will be in and, if it ends sooner than expected, with orders in there is a better chance of steel mills getting over the "confusion" period sooner and consumers getting their steel in a more orderly fashion. Mills are continually sorting and analyzing all nonrated orders to see what type of operational pattern can be made quickly as war contracts are cancelled and as war demands become less.

A SUDDEN end of the Japanese war, however, would for a short time paralyze steel finishing mills because of the impact of cancellations. The possible shutdowns would last only so long as alternate steel mill schedules could be put into effect. That ingot output would be severely slashed is not envisioned because of the need for raw steel when schedules have become reorganized. Once finishing mills are started again, it is expected that most mills will have enough business in their backlogs to keep them running for from four to six months at capacity.

The feeling is growing in the steel industry that the effect of a sudden end to hostilities would not create the sharp dislocation in steel operations which was at first thought. This had ordinarily been due to the slowness of the WPB in relaxing the CMP plan. Yet that slowness has forced the steel companies to keep civilian steel schedules in a constant state of flux and revision. If the volume of nonrated orders which took a terrific upward drive in the Chicago district this past week continues to expand, and provided there is not too much duplication of orders, the changeover from war steel output to complete civilian output will not be too great a hurdle. The WPB, however, believes that there is little chance of abandoning the Controlled Materials Plan before the end of the year despite pressure from steel companies to do so. The latter believe that if CMP were thrown overboard there would still be enough capacity to take care of war orders and a more general leeway properly to schedule civilian business. But such an appeal at the moment has fallen on deaf ears.

SPECIFIC steel market news this week indicated that the large Navy order for a floating dry dock has been placed. The bulk of the 65,000 tons of plates for August delivery went to western steel mills. The more than 40,000 tons of structural steel was distributed among many mills. The placement of this order has pushed back deliveries on rated steel business not as urgent.

Concrete reinforcing bar orders are going begging because the demand for hot rolled steel bars which are subject to allocation has increased substantially in the past several weeks. Concrete bars are not allocated and in the western area alone it is reported that more than 70,000 tons of concrete bar business is awaiting takers. Western mills cannot handle such nonrated business much before the first of the year or later while eastern mills have had to promise as late as November and December delivery.

The automobile industry, which has found sheets tighter than ever even though having been promised their quota, is changing some carbon bar needs over to alloy bars because the former have such extended deliveries. It is also reported that auto companies find a bottleneck in their quest for tin for coating automobile engine bearings and many companies are working on substitutes.

Railroad passenger car output has been revised upward 675 units to carry through the balance of the year. Early indications of the 1946 railroad rail needs show a demand far exceeding the steel industry's capacity to produce controlled cooled rails. Freight car requirements have been so heavy of late that actual completion of the orders placed and those to follow may not take place until a year after the war ends.

The steel ingot rate this week is 91.5 pct, up one half a point from last week's revised rate of 91.0 pct.

• **WHITHER THE STEEL INGOT RATE**—Since VE-Day the steel ingot rate has not gone as low as the pessimists thought it would nor remained as high as the optomists thought it would. One reason it did not drop too sharply was that cancellations were slow in coming and the actual cancellations of steel orders because of cutbacks were even slower—in some cases not having reached mill books yet. In a way WPB insiders say it was planned that way—that is slow leveling off of the rate without a too sharp drop. The open-ending of CMP-which has meant little to civilian manufacturers—was one way to combat a sharp drop. On the other hand with more than enough steel operations to supply the military it may be that many steel makers have taken this opportunity to get their steel making equipment in good shape so as to be in a competitive position when the Jap war ends. Many repairs have been foregone in the past few years and now it is claimed is a good time to do it because it will not hinder the war effort. Summing up the ingot rate question it looks like both sides were right: The rate is economical from a profit standpoint; it reflects repairs, and yet it is high enough to provide jobs and meet in full military requirements. An early approach of VJ-Day would change the picture because civilian order volume has not been too high and war orders would suffer almost complete cancellation. If such a day would come quickly it might result in a temporary sharp and deep drop in the steel rate until the confusion cleared. Yet the fact that the auto industry is on its way might once again be the factor that would prevent a demoralization of steel operations even for a short time.

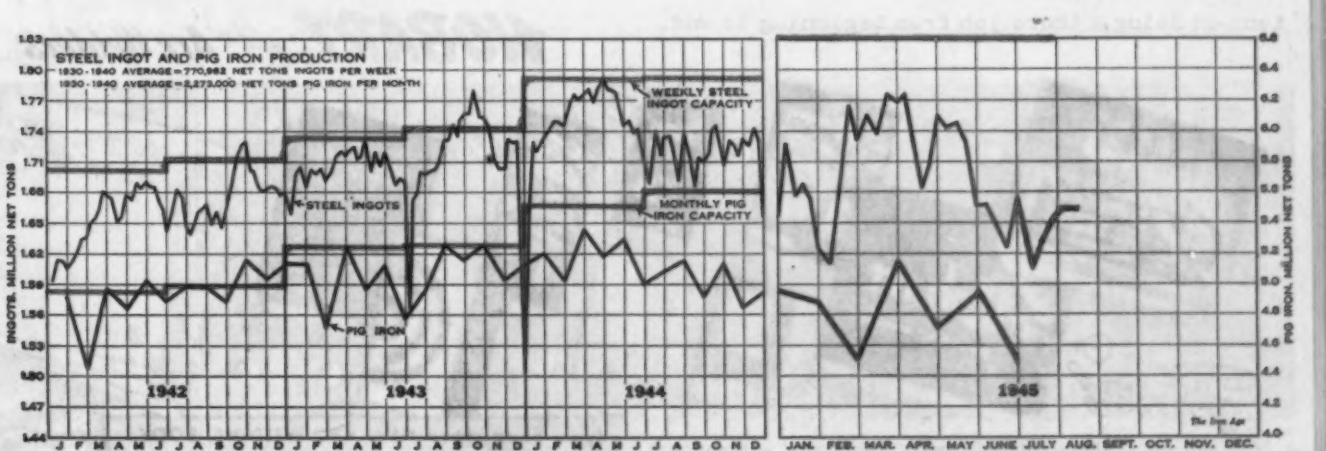
• **KAISER-FRAZER SET-UP**—There is much speculation about the new car that Kaiser-Frazer Corp. will market. Just as there was talk and speculation on the many Kaiser enterprises so again is there this time. According to Stanley Brams in "Assembly Line" this week Detroit is "skeptical." But it is pointed out that the "man on the street" may have a different idea. For a complete discussion of what Detroit and others think turn to page 74.

• **HOW LONG CMP**—Many thought that the Controlled Materials Plan would go out the window in the third or at least the fourth quarter but it is not to be according to L. W. Moffett in "Washington" this week on page 78. For some time there has been undercover fights to get rid of CMP but the military has balked. Most steel men are of the private opinion that to do away with CMP leaving rated orders for war purposes only would work out better for the reconversion period than CMP. As always in war the Army and the Navy have the last say and for that reason steel men do not look for the end of the present CMP until the first of the year at least.

• **FABRICATED STRUCTURAL ORDERS** — June bookings of fabricated structural steel for bridge and building construction reported to the American Institute of Steel Construction by companies representing 77.4 pct of the total average bookings of the industry during the years 1923-1925, totaled 100,006 tons as compared with 51,719 tons reported for the preceding month and 56,239 tons reported for the corresponding month of last year. The June bookings were the highest since July, 1942, when 125,243 tons were booked, and compared with 97,992 tons booked in April of this year. Reported shipments for bridge and building construction totaled 55,884 tons compared with 43,000 tons reported for the same month last year. The reported tonnage available for future fabrication at June 30 was 195,220 tons.

• **BUSINESS FORECAST** — Business conditions and profits will remain favorable for the remainder of 1945 although the steady upward trend in production and income that has continued since 1939 will come to a halt and be thrown into reverse in the second half of the year, according to an article, "National Activity in 1945," in the July issue of the *Survey of Current Business*, Dept. of Commerce paper. How far the decline will carry won't be answered this year and probably not even in 1946, says Louis J. Paradiso and Lawrence Bridge of the Bureau of Foreign and Domestic Commerce's Business Statistics Unit, authors of the article. National income and the gross national product in the second half of the year are expected to decline by less than 10 pct—from the peak levels attained in the first six months. The extent and rate of the decline in economic activity will be determined by the speed of reconversion. The reconversion signals which government has given idustry have of necessity been spotty so far, the article says, because the continuing war production program is not in a settled state and cannot be until the military has had a better chance to size up the needs of the Pacific war.

• **NEW GRILLROOM CAR**—A self-service buffet with sofa seats and chairs are featured in a new grillroom railroad car designed by Pullman-Standard Car Mfg. Co. The car seats 50 persons, compared with 36 to 48 in most conventional diners, with tables along the sides, ends and in the center of the car.


STEEL INGOT AND PIG IRON PRODUCTION
1930-1940 AVERAGE = 770,982 NET TONS INGOTS PER WEEK
1930-1940 AVERAGE = 2,273,000 NET TONS PIG IRON PER MONTH
WEEKLY STEEL INGOT CAPACITY
STEEL INGOTS
MONTHLY PIG IRON CAPACITY
PIG IRON
INGOTS, MILLION NET TONS
PIG IRON, MILLION NET TONS
1942
1943
1944
1945
J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D
JAN. FEB. MAR. APR. MAY JUNE JULY AUG. SEPT. OCT. NOV. DEC.

Steel Ingot Production by Districts and Per Cent of Capacity

Week of	Pittsburgh	Chicago	Youngstown	Philadelphia	Cleveland	Buffalo	Wheeling	South	Detroit	West	Ohio River	St. Louis	East	Aggregate
July 24	89.5	95.5	91.0	93.0	94.0	96.0*	91.0	94.0	96.5	88.0	102.0	87.0	90.0	91.0*
July 31	89.5	95.0	92.0	90.5	94.0	104.5	91.0	94.0	97.0	73.0	102.0	87.0	91.0	91.5

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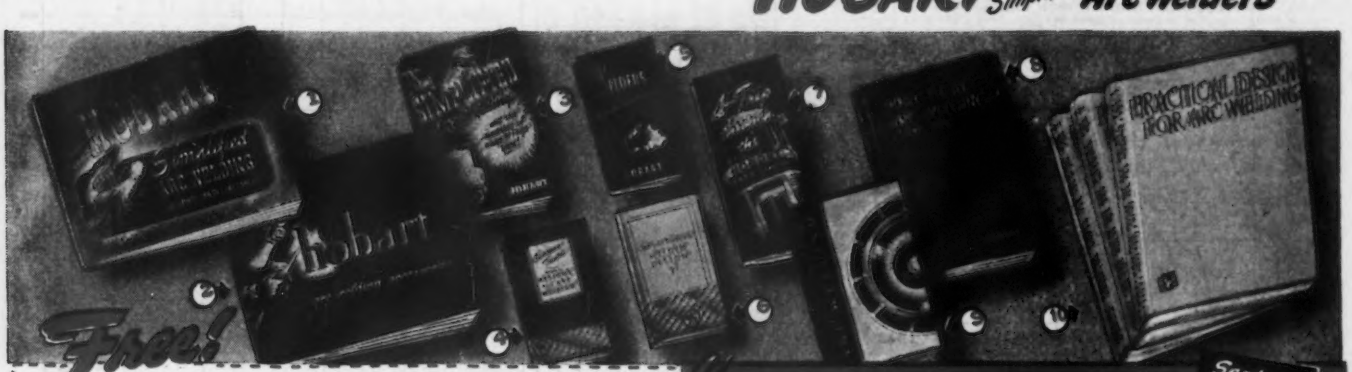

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Study Predicts Disruptive Trends in ICC Rate Case

Chicago

• • • **Battle lines are shaping to attack the Interstate Commerce Commission decision of May 15 in the so-called Southern Governors' Conference case reducing class railroad rates 10 pct within Southern, Southwestern and Western Trunk line territories and from them to and from Official Territory. Class rates are correspondingly raised within Official Territory.**

Objections to the decision stem not so much from the relatively small volume of traffic immediately involved as to the implication that a new principle in rate making throughout the country is in the works.

A study recently released by the Chicago Assn. of Commerce declares, "No longer will rates within different sections of the country be made solely according to the needs within those sections, but the traffic and transportation conditions of all sections combined will be used as a basis for rate making purposes. Uniformity becomes the predominating factor with average costs as the basis for determining the level of rates."

Such a principle carried to commodity rates, leading to isolation of steel producers and manufacturers within territories surrounding their plants, conceivably could become a back door approach to the same disruption as would be achieved by abolition of the basing point system.

Petitions involving the May 15 decision have been filed from all parts of the country and include filings from the governors of the six New England States, the governors of New York, New Jersey, Pennsylvania, and Maryland, the public service commissions of the eleven Mountain and Pacific States, the Wisconsin Public Service Commission, the Chicago Assn. of Commerce, Indiana, Ohio, and Illinois shippers, the Detroit Assn. of Commerce, Kentucky and Oklahoma. Industrial shippers in the South are understood to be preparing a petition, and the Western Lines have asked that the effective date of the interim order be postponed from Aug. 30 to Apr. 30, 1946.

Although the reduction in class rates has been hailed as a boon to the South, the Chicago Assn. of Commerce study indicates that the immediate reductions in shipments to and from that region will redound to the greater benefit of Northern shippers in interterritorial haulings because of the greater volume of southbound traffic. The benefit to the South, it appears, will be greatly limited by the predominant volume of shipments from that region under exception rates and commodity rates. The percentage of all carload traffic moving in the affected territories on Sept. 23, 1942, the test date, interterritorially as in the accompanying table.

	Percentage of Carloads		
Territories	Class Rates	Exception Rates	Commodity Rates
Official to Southern	12.6	36.3	51.1
Southern to Official	0.9	4.9	94.2
Official to Western Trunk	12.3	35.4	52.3
Western Trunk to Official	3.1	1.0	95.1
Official to Southwestern	22.5	52.0	25.5
Southwestern to Official	1.5	3.4	95.9

The delay in application of the interim order has been asked because of the time necessary to make 2,000,000 rate computations in the Western Dist. alone and more than 3,000,000 in all territories.

Of indirect interest to the steel industry is the effect of a uniform rate structure on the individual carriers. In the past, the Commission has frowned on rate reductions which would force the carriers to transport on any class or commodity at below out-of-pocket costs. If the adjustments create such a condition, modification will be necessary.

Also, as the Chicago Assn. comments, "Southern and western carriers must be compensated in some form to offset the loss of revenue resulting from the reduction ordered in their class rates. The only source from which such revenue can be obtained is from an increase in the rates on agricultural products and other commodity rate traffic. Eastern carriers have always earned a return on their investment higher than that enjoyed by either western or southern lines."

Insofar as Official territory is concerned, with increased class rates, a similar line of reasoning would indicate pressure by shippers for a reduction in commodity rates.

Still another possibility is a raise in commodity rates from Southern to Official territory, Northern interests argue. The basis of this contention is the so-called "destination rate principle," recognized in the past by the Commission, in which Southern shippers to the North have received the Northern rate level on such shipments to allow them to compete there. This principle, the Northerners argue, would call for an increase in the commodity rates from the South contemporaneously with the effective date in the increase of the class rate level in Official territory.

As soon as the controversy slops over into commodity rates in any volume the steel industry may be expected to jump in with both feet to stem the flow of the uniformity principle.

CAMOUFLAGED TOWN: *Two women walk along a catwalk running through a camouflaged town that was built over a B-29 plant at Seattle, Wash., to protect it from the threat of possible Jap air raids.*

Mead Report Warns Reconversion Job Not Being Done by Mobilizer Vinson

Washington

• • • **Sweeping criticism** of the government's slow-paced reconversion program as a threat of widespread unemployment, with recommendations for a quick overhauling to solve the problems confronting industry is contained in the annual report of the Mead (Senate) Committee made public July 30.

For only three war agencies did the Committee have kind words — WPB, OPA and Office of Contract Settlement. Especially sharp was the Committee's tone toward the Office of War Mobilization and Reconversion which, the report said, should be put on a supervisory operating basis with direct control over the other war agencies. The office also, it was urged, should be empowered, organized and staffed so that it can take more active steps to aid reconversion, including actions cutting across interagency lines in the furtherance of individual reconversion projects.

The report charges waste of manpower by the Army and urges demobilization of troops as may be required to speed up essential civilian production and services; warns that America's resources including iron ore and petroleum are being depleted and attacks the dilatory disposal of surplus property.

There has not been sufficient help, the Committee declares, from the government to industries and businesses desiring to reconvert. Factors cited as retarding reconversion are delay in planning, delay in announcing and making cutbacks, lack of both raw and semi-finished materials, insufficient information available for industry to make plans far enough in advance and manpower shortages in key localities. Many of our new war plants which are suitable for civilian production should be integrated into our economy, the report says, even if government financing is necessary.

Slowness in reconverting and the failure to release large surpluses, taken together with continued high public income and the return of large numbers of soldiers, it is asserted, creates an increasing danger of inflation due to the large amount of money in circulation and the relatively small quantities of purchasable goods.

Regarding problems of the immediate future, the report cites the need for strengthening the civilian economy and diverting production to peacetime channels to the maximum extent compatible with military needs.

Noting that victory over Japan should mean the virtual shut-down of war production activities, the Committee strongly recommends that OWMR make specific and concrete plans which can be put into operation immediately in the post V-J Day period when production will drop to approximately 10 pct of present schedules.

Continuing criticism of the reconversion lag, present difficulties are highlighted as follows:

"The decks have not been cleared for civilian production. Raw materials have not yet been freed in any substantial volume, although the volume is growing month by month. Few plants have been made available, and little or no additional civilian goods have appeared. Up to June 18, 1945, only five surplus industrial plants had been sold. The sale of surplus machine tools has been delayed first by failure to declare tools surplus, and then by the complexity of the sales procedure.

"Concentration must shift from planning to specific action directed to the reconversion of specific plants. With each plant that is actually reconverted we are that much closer to our goal."

Although most recent estimates of the War Manpower Commission indicate that by the end of the year 2,300,000 persons will have been released from war production, Federal agencies, construction and mining, and the armed forces the Committee believes that this number will not be employed at that time unless a small number of vital workers are made available at once.

This point is illustrated by the fact that about 2000 additional men in the sheet and strip mills could produce enough sheet steel to fill all the immediate needs of reconverted industry. However, the report emphasizes that sufficient sheet aluminum is available, but that there is reluctance on the part of industry to use it.

In addition to accusing the Army of continuing to utilize its manpower wastefully, the Committee says that the Army is also setting up huge reserves of troops which it cannot hope to use in the Pacific war except in the event of a disastrous set-back.

The Committee reported that the primary bottleneck affecting reconversion of the automobile industry is the failure of other agencies to coordinate with the program of WPB, particularly in regard to machine tools, prices, and materials. The reconversion probblems of other industries, such as the mechanical refrigerator producers, are not as great and early 1946 should see substantial production of the major electrical appliances.

In its discussion of renegotiation and repricing the Committee is doubtful whether another extension beyond the end of 1945 is desirable, based largely on the fact that contracting agencies should now have adequate information on which to base fair initial pricing.

Depletion of natural resources is

Recommendations Of The Mead Committee

1. The Office of War Mobilization and Reconversion should be put on a supervisory operating basis with direct control over the other war agencies. At this stage of the war program, it is particularly the reconversion functions of this office which require such attention.

2. The various civilian agencies dealing with foreign governments and peoples should be integrated under the Secretary of State.

3. We must now utilize and divert into peacetime channels our productive capacity that is not needed for our military production. There should be consideration given to the release now from the armed forces of a limited number of men whose services are essential to early reconversion of industry. Among the principal industries needing workers in this category are lumbering, transportation, coal mining, cotton textiles, and, to a limited but important extent, steel. War-production programs should be cut back as soon as possible, with more advance notice to industry.

4. In order to direct workers to the places where jobs will be available and to provide the types of workers needed where industry is short of labor, accurate information must be gathered and made available to workers and employers.

5. Surpluses must be declared and moved more expeditiously and with a more definitely coordinated policy.

6. Attention must be given to the conservation of the country's resources and to the accumulation of stock piles of strategic materials.

recognized as a serious problem and an adjunct to national security must necessarily be conservation and careful stockpiling of vital raw materials. The Committee warns that "we cannot oil another war," and that reserves of high-grade, easily accessible iron ore have been so depleted that continued consumption at the present rate would result in exhaustion in as little as eight years.

Technological research and a study of the question of the desirability of decentralizing industry are also urged as important to future national defense.

Pointing out that the Office of War Mobilization and Reconversion has not attempted to run war mobilization the Committee recommends that OWMR should have a strong reconversion division with actual operating functions and with all subsidiary agencies, WPB, OPA, etc., directly subordinate to it, with a reduction in the number of these subsidiary agencies. While the Committee does not believe that this would completely eliminate interagency conflicts it would place OWMR in a supervisory position.

J&L Net Income Rises

Pittsburgh

• • • **Jones & Laughlin Steel Corp.** reports for the quarter ended June 30, 1945, a consolidated net income for the Corporation and its subsidiaries of $2,357,524 after all charges, including depreciation, depletion, interest and taxes, equal after preferred dividend requirements to $1.01 a share on common stock. This compares with a net income of $1,879,835 or 71c a share reported for the quarter ended June 30, 1944.

Consolidated net income for the six months ended June 30, 1945, was $4,371,013, equal to $1.81 a share on common stock, compared with net income of $3,588,187 or $1.32 a share on common stock, reported for the same period of 1944.

Paul Dearing Killed

New York

• • • **Paul Dearing,** who several years ago had been Buffalo correspondent for THE IRON AGE, was killed in the Empire State Building disaster, July 28. Mr. Dearing at the time of his death was a volunteer worker for the War Relief Services of the National Catholic Welfare Conference, and special representative of the Buffalo Courier-Express.

Republic Expansion Program Will Increase Flat Rolled Output

Cleveland

• • • **Another step** toward broadening the flat rolled facilities of the Republic Steel Corp., an expansion at the 98-inch strip mill in the upper Cuyahoga Valley, totaling almost 50,000 sq ft of additional floor space, and providing additional annealing capacity of 10,000 tons a month, was announced this week.

Plans call for two separate extensions to the cold mill building to house coil and sheet annealing furnaces, bringing the total annealing capacity of this installation to 43,000 tons a month. The coil furnace building will be 240 ft x 105 ft and the sheet annealing extension will be 120 ft x 105 ft. There will be seven coil annealing furnaces, each capable of handling stacks of coils 12 ft high, and two additional sheet annealing furnaces. Approximate cost of this project will be about $1,090,000.

Announcement of this expansion, pointed for early postwar completion, brings to more than $7,000,000 the amount the Republic Steel Corp. is planning to spend in rounding out their present flat rolled picture.

Other projects include:

Installation of a multiple slitting machine with accessories to increase strip production here in Cleveland. This will cost $150,000.

Construction of a plant addition at Niles, Ohio, 108 ft x 220 ft x 48 ft, for annealed strip production, costing in the neighborhood of $863,000.

Republic will also install additional annealing capacity for strip in the tinplate plant, for cold reduced black plate. Two DPC electrolytic tin lines used on electrogalvanizing are already in this plant, which at the present time has been using hot rolled bands from Warren. This addition, which will cost $335,000, will eliminate this practice.

In Youngstown, Republic will erect building additions and install stands, a coiler, and furnace and auxiliary equipment at the plate mill, an 84-in. 3-high plate mill on which the company has been rolling skelp.

Two 4-high stands will be added to this mill—the original three will be used for roughing the skelp down and the new additions for finishing, enabling Republic to roll the lighter gages. Plans for the Youngstown facilities also call for the installation of a heavy duty vertical edging stand, dimensions 16-in.-14-in. bar mill, an open-hearth with necessary motors and controls for operation. This project, which will augment production of bars and shapes, will cost in the neighborhood of $107,000.

In Massillon, equipment for cold rolling, pickling, annealing, and cleaning will be installed as a part of Republic's stainless steel strip program. Slitting units, with coilers and tractors, and the construction of a minor sub station are also included. Cost of this improvement will be $943,000.

Republic's Berger Mfg. Div. in Canton, Ohio, will have three mill buildings rehabilitated and spot welders installed along with bonderizers, a drying oven and graining machines in the sheet fabricating plant. Purpose of this project, the production of unit heaters, will cost about $640,000.

Present indications are that this program, which has War Production Board approval, will about equal Republic's capital expenditure of 1943, which amounted to $6,308,049, and will probably surpass the $4,464,833 outlay last year. Authorization for some of these improvements amounts to little more than a hunting license under current conditions.

New All-Wheel Drive Trucks Are Announced

Indianapolis

• • • **With the announcement** of new heavy duty all wheel drive trucks for civilian purposes, postwar planning takes definite form at Marmon-Herrington Company, Inc., Indianapolis.

Production is scheduled to start soon, and is to be concentrated on two models. The larger of these, will be powered by a 131 hp. engine, on a wheelbase of 161 inches, with a permissible gross loaded weight of 27,000 lb. A slightly smaller model will be powered by a 118 hp. engine, on a wheelbase of 158 inches, with a permissible gross loaded weight of 22,500 lb. Both models will have 10 forward speeds and 4 reverse.

Brazil Has Funds For Buying Road Machinery in U.S.

Washington

• • • **More than** $5,000,000 worth of tractors, trucks and other highway building machinery will be shipped to the state of Sao Paolo, Brazil alone as soon as the war ends, Senor Carlos da Silveira Lichtenfels told representatives of the American Road Builders' Assn. and the Office of Inter-American Affairs at a conference here recently.

The Brazilian highway engineer on leaving Washington will spend several months visiting American plants producing highway construction machinery and calling on state highway departments to study up-to-the-minute planning, construction and maintenance methods as practiced in the United States. His itinerary is being worked out to give a comprehensive picture of all phases of road building in this country.

"The state of Sao Paolo expects to build 3000 km of new highways and improve 6000 km of existing roads in the next five years," Sr. Lichtenfels said. "This will include the completion of two super-highways of 145 cm and involve the movement of 12 million cu m of earth.

"The highways to be improved include the radial highways which branch out from Sao Paolo like the spokes of a wheel, while new construction will comprise transverse roads uniting the radial highways like a spider's web. The estimated cost of this program is $16,900,000 of which 75 pct has been raised by an issue of 7 pct state highway bonds purchased by the banks of Sao Paolo. The remaining 25 pct will be secured by taxation," the visitor stated.

Sr. Lichtenfels who until recently has been in charge of the planning and location of the mountain section of the Via Anchieta Highway uniting the Brazilian coffee port of Santos with the industrial city of Sao Paolo, painted an optimistic picture of post-war highway construction in South America, and referred to the admiration of Latin-American engineers for our machinery and methods. His visit to the United States is to secure advanced techniques of building and maintenance which he can take back to Brazil.

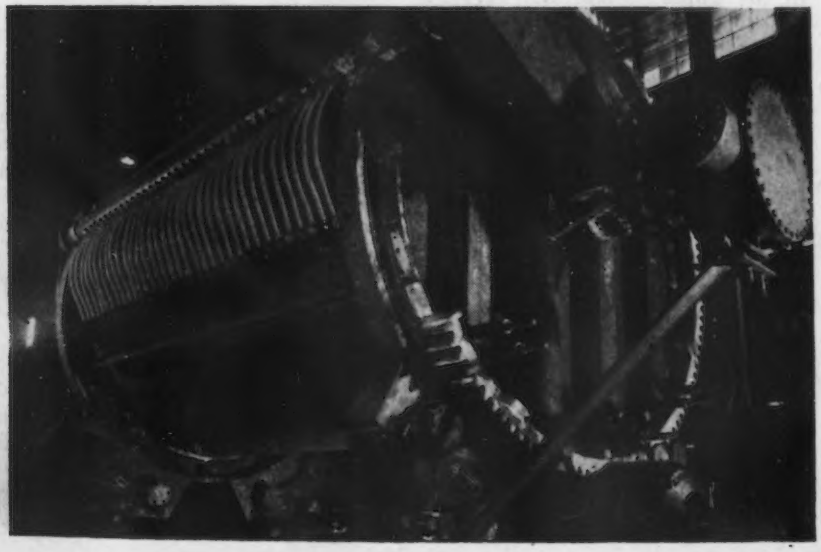
Class B CMP Rule Changed

Washington

• • • **Manufacturers** of class B products are not required to file applications for CMP allotments, the WPB announced on July 28.

Interpretation 34 to CMP Regulation No. 1 says that although no longer necessary to file a CMP-4B, a manufacturer may obtain his materials without the use of ratings and allotments, or by extending his customers' ratings to get non-controlled materials.

RUSSIAN CONVERTER: *Destined for a Russian smelter, this Allis-Chalmers copper converter has riding rings which permit four more tuyeres to give increased efficiency in blowing the charge. Cone shaped flanges on tuyere bodies facilitate entrance of the tuyere punching rod.*



Allocations to Get Further WPB Paring, According to Krug

Washington

• • • **Indicative of** decreased scheduling in the fourth quarter, WPB Chairman Krug said July 27 that steel allocations will be pared and in some cases eliminated altogether as a result of a survey now being conducted.

Pointing out that the elimination of CMP controls earlier than Dec. 31 had been asked by the steel industry, Mr. Krug emphasized that sufficient quantities must still be made available for war supporting activities.

"CMP will stay until I'm sure that the railroads, utilities, the oil industry and farm machinery manufacturers get their needs," Mr. Krug said.

Some materials, particularly tin, will continue very tight but copper and aluminum will be plentiful in the fourth quarter, Mr. Krug said.

Reconversion has been proceeding slowly, partly because the reduction of war activities in many sections has been gradual, he said, with productive capacity being taken up quickly by continuing war production programs or diverted to civilian activities.

Commenting on requests by some producers for continued priorities assistance well through the reconversion period, Mr. Krug said that, almost without exception, industry would prefer to go ahead on its own in securing materials.

"We should get out of this priority idea as soon as possible," he said.

Tendency on the part of many West Coast war workers to quit jobs not immediately affected by cut backs may hurt production schedules, Mr. Krug said. Uncertainties as to job duration has not only affected aircraft workers but is peculiar to other "war baby" industries.

On the spot offers of like-paying jobs in other war plants were accepted by only 100 of 3200 workers recently laid off by a western aircraft manufacturer as a result of a cutback, Mr. Krug said, a variety of reasons having been given for not continuing work immediately. Of those not already employed elsewhere, some decided to vacation, others returning to their home states for more permanent jobs.

Flat Rolled Steel Business Continues To Be Very Heavy

Pittsburgh

• • • Contradictory reports in this area on sheet and strip indicate both that validated orders have dropped off and that validated orders are still coming in in their usual volume. These reports, depending upon the sheet and strip source, do nothing more than merely confuse the already complex picture. One thing is certain, however, there has been no appreciable effect on the backlogs of flat rolled products, and unrated orders are still a long way from being scheduled or rolled.

The manpower situation in the sheet mills probably has as much to do with the current tight situation as anything. Mills are finding it extremely difficult to get shearmen, trained cold rolling crews, and other specialized types or workers. Consequently, very few if any of the sheet mills are working at capacity. Some mills estimate that the lack of manpower alone is cutting its flat rolled production as much as 20 pct to 25 pct. This amount, added to present output, would go a long way in overcoming the present scarcity of sheets.

The recommendation of the Sheet and Strip Steel Industry Advisory Committee to the WPB to abandon CMP on sheets and substitute immediately the "MM" band and unrated civilian orders is met here with some degree of amazement. Despite the fact that this may allow more flexibility, it is pointed out that since no unrated orders are being filled such a change in scheduling would only be transferred from CMP validated orders to "MM" orders.

According to WPB, the plan to order 200,000 steel tents in November will be at least partially abandoned in so far as steel sheet is concerned. Aluminum corrugated sheets will be substituted for galvanized steel sheets, thus cutting down some of the military demand.

While WPB expects an easing of the sheet strip picture by the end of the third quarter through cutbacks and reduction of inventories, deliveries are still far extended in practically all flat rolled products with the exception of heavy gage hot rolled sheets.

One producer is offering cold rolled sheets in November, but another in the district is quoting December and January. Hot rolled and pickled sheets, depending upon the source, show deliveries of November and January in the district and March from outside the district. Hot rolled sheet schedules are well into next year, and galvanized sheets are now being scheduled in March and April.

It is believed that a considerable percentage of the unrated business on the mill books at the present time will never be delivered, since much of it is felt to be duplicate business that will be cancelled as soon as controls are relaxed and the supply catches up with demand. Producers indicate that they are unable to tell when civilian unrated business will be scheduled, despite the fact that this business is now building up on the books at a terrific rate.

Blaw-Knox Shipments Up

Pittsburgh

• • • W. P. Witherow, president, Blaw-Knox Co., reported shipments for the first half of this year were almost double those for the same period in 1944 and added that, "because unfilled orders were so predominantly for Navy ordnance materiel, operations were likely to continue through the next quarter at the prevailing rate." Company operations beyond the third quarter, Mr. Witherow declared, will depend on requirements for the war and the extent to which reconversion becomes effective.

Blaw-Knox Co. earnings for the first half of 1945 were $1,432,718, which compares with $865,799 for the corresponding period of 1944, and $1,303,618 in the final half of 1944.

Russian Labor Group Tours War Plants With CIO Officials

Chicago

• • • Members of the Russian labor delegation visiting the United States at the invitation of CIO President Philip Murray toured Chicago war plants and conferred with local CIO leaders here last week.

Jean Brodier, secretary-general of the Catholic Trade Unions of France, who coordinated the French resistance movement among labor and who was a prisoner of the Gestapo, also was among the group honored by the CIO.

Heading the Russian delegation was Vasili Kuznetsov, All Union Central Council of the Trade Unions and head of the U.S.S.R. delegation to the World Trade Union Conference in London early this year. Other members included N. Gaisenok, shipbuilding union; M. Shdanov, chairman, Naval Transport Workers; K. Kuzakov, government employees; A. Stepanov, member, Central Council of Trade Unions; B. Gostev, automobile workers; A. Orlova, sewing factory workers; I. Chevtaev, sawmill workers; I. Shostak, high school and scientific institution workers; M. Falin, assistant to Kuznetsov; and L. Samoshina, interpreter.

The Russian group was scheduled to hold similar conferences and visit Detroit plants early this week as the guest of CIO leaders there.

SCAPA FLOW DEFENSE: *Part of the defense system against submarine attack at Scapa flow consisted of these steel cable nets. These British seamen are conducting a repair job.*

Bethlehem Unconcerned Over Disposition Of Western Steel Plants

New York

• • • The melee concerning disposition of the Geneva and Fontana steel mills will not find Bethlehem Steel Co. a participant, Eugene G. Grace, president, told reporters after the quarterly meeting of directors held in New York, July 26. "Our prices will meet competition on the Pacific Coast," Mr. Grace said. "We can produce and deliver plates, tinplates, sheets, pipe, wire products and bars made at Sparrows Point, and structural items made at Bethlehem, Los Angeles, San Francisco, Portland and Seattle at a cheaper cost than steel can be made locally."

In the second quarter of 1945, Bethlehem earned $8,040,682 or $2.15 a common share. For the same period last year, earnings amounted to $6,733,843 or $1.71 a share. For the first time in several years, new orders in steel have declined, from 5,077,000 tons at the beginning of the period to 4,125,000 tons at the end. Contract cancellations, mainly in heavy ordnance items, were responsible for a decline of $60,000,000 in steel bookings.

Employment in the second quarter of this year averaged 220,656, compared with 237,370 in the first quarter. Overtime work also declined, the average work week for the period being 44.8 hr compared with 46.9 hr in the first quarter.

Steel output, which is currently at 97 pct of capacity, averaged 98.2 pct during the second quarter, compared with 98.3 pct in the first quarter and 103.0 pct in the second quarter of 1944.

If materials and labor become available, the company intends to complete in 1945 new construction amounting to $20 million for steel plate improvements and additions, mine developments and new freighters. In this quarter $3 million was spent for new construction.

The usual dividends of $1.50 a share for common stock and $1.75 a share for preferred stock were declared by the board.

Cold Finished Bars Price Adjustment Made

Washington

• • • Effective Aug. 6 an increase of $2 per net ton in producers' base ceiling price for all types and qualities of cold finished carbon steel bars, with offsetting reductions of $2 and $6 per ton respectively for "two" extra charges for certain annealing and testing operations performed on cold finished bars was announced by OPA on Aug. 2. This will increase the base price of cold finished bars to 2.75c. Warehouse and jobber resellers were authorized to pass the increase to their customers in sales of cold finished bars in stock as well as future receipts. On May 23 OPA increased the prices of hot rolled merchant bars $2 per ton and hot rolled wire rods $3 per ton.

The increase in ceiling prices of cold finished bars, combined with the simultaneous reduction in the two extra charges represents the first compensatory price adjustment of its kind in the iron and steel field since the beginning of price control.

The price changes are as follows:

1. The ceiling base prices for cold finished carbon steel bars are increased 10c. per 100 lb, or $2 per ton for all types and qualities.

2. The extra for producing cold finished bars to United States Government specifications requiring physical testing is reduced to 15c. per 100 lb or $3 per net ton from 25c. per 100 lb or $5 per net ton.

3. The stress and strain relieving extra for cold finished bars produced under Army and Navy specifications for use in manufacture of shells and other ammunition components is reduced to 45c. per 100 lb or $9 per net ton from 75c. per 100, or $15 per net ton.

Discussing the reason behind these price changes, OPA pointed out that the majority of cold finished bars are produced by non-integrated companies that buy hot rolled bars and rods as raw materials which narrows the spread between the hot rolled bars and rods and cold finished products and results in a reduction in the margin between the cost and sales prices of cold finished bars. At the same time OPA explained that the larger companies that have facilities for supplying revenue producing extras in their production of cold rolled material for munition components are in a position to absorb the hot rolled product price increases.

By this procedure of increasing the ceiling price for cold finished bars and reducing the charge for extras, OPA said, the average realization to the industry for cold finished carbon bars will remain the same as before the price adjustment.

Cold finished bar producers will be required to file quarterly returns with OPA, giving their tonnage production totals so that the price agency may check the dollar increases granted and make any price adjustment that may be necessary as cold finished bar production shifts from a wartime to a peacetime basis.

ELECTRONIC GAGE: *Sylvester Phendler, blind employee at Timken, Canton, Ohio, gages the outside diameter of roller bearing cups by means of the new electronic sound device developed by Timken engineers. Sgt. Robert McFarrin, former employee, now on leave, looks on.*

R. C. Allen Now Vice Chairman

Washington

• • • R. C. Allen, Cleveland, has been appointed vice chairman of the Office of Metals and Minerals of WPB, succeeding William C. Keeley, Fairfield, Conn., who has resigned. Mr. Allen was appointed deputy vice chairman for metals and minerals June 27. He was formerly executive vice president of Oglebay, Norton & Co., an iron ore mining company of Cleveland.

AAF Unveils P-80 Powered by Super G.E. Gas Turbine

Mitchel Field, N. Y.

• • • The jet propelled P-80 Lockheed Shooting Star was unveiled this week in joint exhibitions across the country in celebration of the 38th Anniversary of the founding of the Army Air Forces.

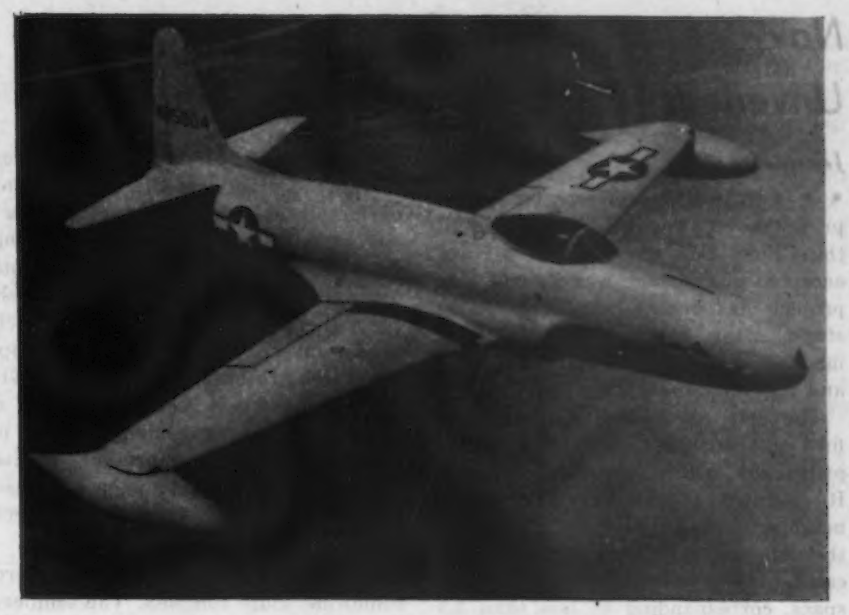
Although the existence of the first AAF combat jet fighter had been announced earlier this year, no public display had been made. Location of the G.E. "superjet" engine almost dead center of the fuselage pours the jet exhaust out through the tail of the plane. Air intakes are faired into the fuselage near the wing roots, and the pilot is pushed well forward of the wing.

To combat the tremendous fuel consumption characteristic of present-day jet-gas turbine units, the P-80 is equipped with jettisonable extra fuel tanks faired into the wing tips. This location is unusual in terms of general aircraft practice, in that a prior view was that the extra weight in such a location would adversely affect the spin characteristics of the craft. According to Lockheed the additions of these tanks renders the shooting star capable of handling missions now carried out by "conventional fighters."

Official statements classify the new fighter as capable of 550 mph, with a ceiling of well above 45,000 ft. Wing span is slightly over 38 ft, with an all up weight of about 14,000 lb.

Although no statement has been made as to combat action of the new fighter, it was disclosed that the prototype plane first flew in January of 1944. On a normal aircraft research program 18 months following the first flight should see the plane ready for combat in considerable quantities. Although the production program on the P-80, being the first large-scale jet program is admittedly not a "normal" research program, at the same time considerable extra pressure of effort and expense has been expended to bring it to its peak as soon as possible.

Thus, barring some major production difficulty on the jet engines, the P-80 should be reported in actual combat in the immediate future.



SHOOTING STAR: *The AAF's combat jet fighter, Lockheed-built P-80 Shooting Star, is powered by an improved General Electric gas turbine engine, and is reported to be capable of speeds in excess of 550 mph. The jet exhaust is through the length of the fuselage and out under the tail.*

USWA-Wildman Contract Guarantees Annual Wage

Pittsburgh

• • • The "guaranteed annual wage" has been written into the contract between Wildman Mfg. Co., Norristown, Pa., and the USWA-CIO, according to the CIO's publication *Steel Labor*. The plant has until recently been producing war material but has resumed production of textile machinery. It is believed that this is the first contract with a metal working company containing a guaranteed annual wage provision.

Wildman agrees to guarantee a minimum of 1200 hours of work a year for every employee who has completed five years' continuous service. All hours worked, both straight time and overtime, shall be credited against the 1200 hours, and if there is not sufficient work for employees to complete the 1200 hours, the employees shall be paid for the unworked hours at straight time hourly rate.

The plant employs about 325 workers and about 70 pct are eligible under the plan. In event of a strike, the company shall be relieved of its guarantee as to the employees striking.

Soaking Pit Strike At Edgar Thomson Stops Steel Output

Pittsburgh

• • • The refusal of two soaking pit cover operators at the Edgar Thomson Works of Carnegie-Illinois Steel Corp., to work without an additional helper resulted in a trike that has tied up all steel production, curtailed pig iron production of three of the eight blast furnaces at the plant, and made idle between 1000 and 1200 workers.

The strikers walked out on Sunday afternoon at 4 P.M. when a request for another helper met with no immediate action by the company. Cranemen at the soaking pits of the 45 in. slabbing mill went out in support of the strikers. At 9 P.M., soaking pit cover operators at the rail, billet, and splicebar mills, along with the cranemen, walked out. In total, the actual strikers number about 30.

However, because of the stoppage of operations at the soaking pits, all 16 open hearth at the plant went down by Monday morning, the four Bessemer converters shut down Monday afternoon, and three blast furnaces were taken out of operation by Monday noon. All that was in operation at the plant by Monday evening was the foundry, some maintenance departments, and a limited amount of finishing.

The company pointed out that it was unable to immediately respond to the strikers request, which had been informal, since grievance machinery has been set up to handle such matters. There have been no grievances filed on the matter. Steel losses to 4 P.M. Monday totaled about 1900 tons.

Navy's First Gas Turbine Unit Unveiled; 2500 Hp for Ship Propulsion

Jeannette, Pa.

• • • **A world premiere** on a new prime mover was held this week at the Elliott Co., when the first Navy accepted gas turbine was shown. The project has reached the completion stage after thorough going tests made under the direction of Elliott and Navy engineers.

The unit, a 2500 hp engine, is the first gas turbine designed for ship propulsion in this country to be built. It operates at temperatures in the neighborhood of 1400 deg F., with a thermal efficiency of 32 to 34 pct. It can be installed in a 16 x 12 x 12 ft. space, corresponding to less than 3.5 cu ft per hp, with a total weight of less than 30 lb per hp.

This **hot air engine** compares very favorably with diesel type engines with regard to fuel consumption and with the steam turbine in regard to maintenance and service, but on a weight-space per hp generated basis, the gas turbine is superior to either of these.

The hindrances that have slowed up the development of the gas turbine in the past, according to Elliott officials, have been basically the development of a compressor of sufficient capacities to run the plant and the development of metals able to withstand the terrific heats generated in the plant. The first problem was attacked by Elliott engineers by modifying a Swedish type, the Lysholm compressor, which works on the basis of gear pump. Pressures are brought up in this positive displacement compressor by a modified gear arrangement. Elliott is using this type compressor in its turbine, manufacturing it on a license from Ljungstroms Angturbin, holders of the patents on the equipment.

The metallurgical problems were somewhat more complex. The temperature variations throughout the plant are extreme, and the materials used in construction of the unit as well as the joining of the components presented unusual fabrication problems. The compressors are generally of cast iron, with carbon steel ducts carrying the air at 400° F. to the intercooler, an admiralty metal tubular arrangement. The regenerator where temperatures range from 750° to 900° F., has an extensive nickel tubular arrangement. In manufacturing the regenerator, it was necessary to have many joints that would transmit heat from the tubes to the fins. There are over 8.5 miles of nickel tubing in each regenerator, and joints had to be strong enough to withstand constant temperatures exceeding 1000° F. Copper brazing was used in these joints. The combustion chamber reaches temperatures of 1700° and the ducts and lining are subjected to 1400° temperatures.

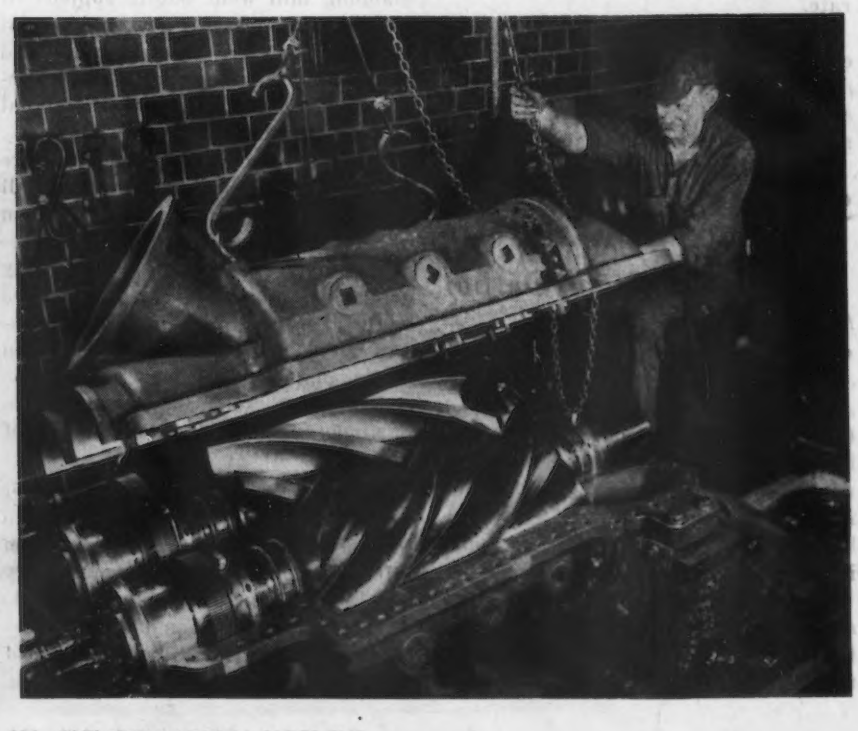
Extensive use of welding in the construction of the gas turbine brought up some interesting problems. For example, after welding SAE 4130 chromium-molybdenum, air hardening steel, each weld had to be inspected before being made to determine whether or not preheating was required. Welding the 19-9 Tungsten-Molybdenum steel, shown in fig. 3 as "special chrome-nickel steel" was a completely new problem since the material is a newly developed high temperature steel. It was necessary to develop a welding electrode, since all existing ones were tested and found to be short of the necessary high temperature strength. Further, operating characteristics of the electrode had to be examined, procedures in laying weld metal had to be devised so as to eliminate cracks, and many tests had to be made.

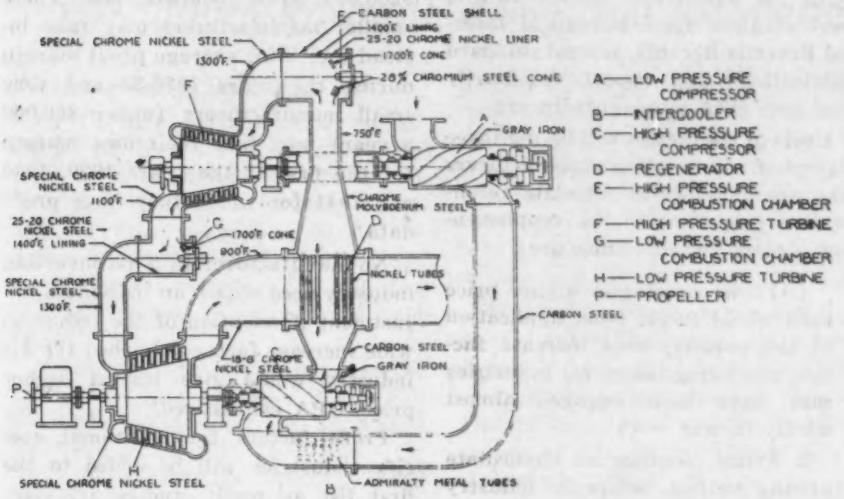
All of these factors had to be completely examined before the turbine could be put into operation. Through the efforts of Elliott Co., and the Navy, in a period of three years a new type prime mover was developed from an idea.

As to the applications of the gas turbine as a prime mover, it is felt that with the development of units capable of using different type fuels than the present No. 2 diesel oil, cost of operation will drop sharply compared to those of a diesel plant. Also, investigations are underway for the use of powdered coal, coal in oil suspensions, oil derived from coal, and other such fuels. However, even in its present stage, cost of the unit and its operation compares very favorably with other power units. Marine applications are extensive, as evidenced by the Navy in its purchase of two units and by the Maritime Commission in its purchase of one unit. Only one has been built, but work on the additional units will get underway shortly.

Packaged power units offer an attractive possibility. Since the gas turbine needs no water and is light and compact, it can be mounted on skids and moved into unusual places for operation. The unit can burn natural gas easier than any other fuel,

SWEDISH COMPRESSOR: *Vital to the successful operation of Elliott Co.'s new gas turbine is the* 12,500 *cu ft per min Elliott-Lysholm compressor shown here with upper casing removed. Air enters the bottom of the casing at the right. Bites of air are trapped by successive pairs of helical lobes. As the rotors turn, the male and female lobes intermesh and compress the air until finally the discharge port is uncovered and the air squeezed out in rapid overlapping bites, producing a steady flow of compressed air. The quantity of air is directly proportional to the speed of rotation and is independent of discharge pressure.*





GAS TURBINE: ***The temperature variances encountered in the Elliott-Lysholm gas turbine cycle are extreme. Materials and joining methods that would withstand these variances presented many difficulties in the design of the unit. The temperature variances and the metals used in the gas turbine are shown in this schematic drawing of the system.***

so that where there is lots of gas it can be used most conveniently. Also, smaller units have been designed as auxiliary power plants for such uses as the aircraft industry might put them to. For example, it can be used for power for guns, to air condition cabins, or to pressurize cabins. This unit, whose design calls for a weight of only 100 lb, is planned to develop 100 hp. Also, its application as power sources for airplanes is extremely interesting. The gas turbine varies basically from the jet engine only in that the jet engine is a gas turbine with jets. Further, coupling a propeller to the gas turbine along with the jet principle is already being investigated. It is felt that a wide use of the gas turbine principle can be found without displacing to any great extent the already existing prime movers, namely, the diesel, gasoline engines, and the steam turbine.

License Crucible Steel To Produce "Cor-ten"

Pittsburgh

• • • **Carnegie-Illinois** Steel Corp., subsidiary of U. S. Steel Corp. announced this week that Crucible Steel Co. of America had been licensed to manufacture "Cor-ten," well known corrosion resistant, high strength, low alloy steel developed by Carnegie. Cor-ten was produced solely by subsidiaries of the U. S. Steel Corp. until the latter part of 1944 when Lukens Steel Co. and Republic Steel Corp. were licensed to manufacture it.

In commenting on the entrance of Crucible Steel into the manufacture of this item, Thomas J. Hilliard, general **manager of sales,** Carnegie-Illinois Steel Corp., said: "This important new producer should give added impetus to the development of lighter weight mobile equipment, based upon the use of improved openhearth steels of moderate cost, yet possessing enhanced strength, toughness and resistance to corrosion. The value of these steels in eliminating dead weight in all types of mobile structures is becoming widely recognized and should lead to broad development."

More than 50,000 railroad freight cars constructed in whole or in part of "Cor-ten" are now in active service, as well as many mine cars, trucks, buses, and other vehicles.

Strikers Return To Three Chicago Plants

Chicago

• • • **Workers at Republic Steel Co.'s** South Chicago plant, whose abrupt walkout last Friday left two openhearth furnaces with untapped heats, returned to work Monday morning. The dispute, over promotion of a workman, was submitted to grievance procedure. About 3700 were affected. Foremen tapped the uncompleted heats.

The 44 in. and 76 in. hot strip mills, the cold strip mill, and the tinplate mill of Inland Steel Co.'s Indiana Harbor plant were closed last week by a strike commencing Tuesday. Operations were resumed at the 76 in. mill Saturday night, the cold rolled and tinplate departments Sunday night, and the 44 in. mill Monday night.

A walkout of 20,000 workers at the Dodge Chicago plant of Chrysler Corp., halting the manufacture of B-29 engines, has been terminated by a WLB directive.

J & L to Expand Its Tinplate Facilities

Pittsburgh

• • • **About $12 million** will be spent by Jones & Laughlin Steel Corp. in an expansion program at its Aliquippa Works tinplate department. Already ordered is a five-stand four-high 42-in. cold reduction mill which will be faster than any mill of its type yet built. Mesta will build the mill. Also to be purchased are pickling and annealing facilities to complement the increased cold reduced sheet output. This equipment, according to a company official, has not yet been ordered but the plans for it are complete.

Installation of the new mill and the auxiliary facilities will require about 12 months and is part of the company's plan to increase finished steel output at all its plants.

At the sheet and strip mill in Pittsburgh, J&L will increase output of cold rolled sheets by nearly 3000 tons a month by Sept. 1, by means of reorganization and rearrangement of its present facilities. Cold reduced steel for tinplate has been supplied in the past by the 54-in. mill at the Pittsburgh strip mill, and, while the newly planned equipment at Aliquippa will furnish the bulk of the cold reduced stock for tinplate, the Pittsburgh unit will continue as an additional source of supply. Through the plan, J&L tinplate producing capacity is expected to be increased about 50 pct.

As part of the expansion program at J&L, it was announced some time ago that a program costing $3 million had been started for sheet capacity increases at the Otis Works in Cleveland. This installation will be started next February and completed by July, 1946.

At the J&L wire mill in Aliquippa, additional equipment is now being installed for drawing finer gages of wire. Postwar markets in this field are expected to be quite substantial, while military demands for fine gage wire have been heavy for some time.

Profit Factors Issued For Reconversion Of More Industry Groups

Washington

• • • "Profit factors" for reconverting manufacturers in 17 specified industries and six industry groups were isued by OPA on July 25. These profit factors will be used in working out rapid individual adjustments in ceiling prices of civilian products coming back into production.

The industries, industry groups, and the profit factors are:

1. Specified industries: Aluminum cooking utensils (sheets)—6.2 pct; aluminum cooking utensils (cast)—2.3; bicyles—3.8; clocks and watches—5.5; coin operated machines—2.4; household scales—4.1; lighting fixtures—2.6; metal caskets—1.6; metal office furniture ——5.4; metal toys—5.1; musical instruments except pianos and organs—3.1; office and store machines——8.9; photographic accessories and equipment—8.1; radios and phonographs—3.0; safes and vaults—3.9; small firearms—4.7; wood and upholstered furniture—1.6.

2. Industry groups: Beds, mattresses, etc.—3.2 pct; small electrical appliances—4.9; sporting goods —3.1; miscellaneous non-ferrous metal products—5.2; other miscellaneous durable products — 3.6; other wood products—3.6.

The profit factors equal one-half of the average percentage margin of profit over total cost for the industry or industry group in the period 1936-39. These profit factors are to be used only when they are higher than the firm's own prewar margin over cost.

By using these factors, in combination with adjustments for increases in materials prices and basic wage rates, individual reconverting firms may, under the orders issued on July 23 obtain price relief over and above prices established after industry-wide reviews of existing ceiling prices of reconversion products.

These profit factors do not indicate the relative profitability of the industries or industry groups named, OPA pointed out. Profitability takes in many other factors not included in the announced profit factors.

Only averages, covering many firms in each field, are given by the factors. Data for calculation of the factors were obtained from Bureau of Internal Revenue Records, several standard publications and report voluntarily filed with OPA by manufacturers.

Users of the factors will be the three classes of reconverting manufacturers who are expected to calculate reconversion prices under the supplementary orders issued. They are:

1. Firms needing a higher price than would result from application of the industry-wide increase factors now being issued for industries that have been engaged almost wholly in war work.

2. Firms needing an immediate pricing method, before the industry to which they belong requests or receives an industry-wide increase factor.

3. Firms in industries that did not convert as a whole to war work and therefore will not have an industry-wide increase factor assigned.

Use of the factors is not mandatory in the case of manufacturers who do an annual business not in excess of $200,000, OPA pointed out. These smaller manufacturers may take instead their own average profit margin during the years 1936-39 and very small manufacturers (under $50,000 a year) may take their own margin for the first of the years 1939, 1940 and 1941 for which they have profit data.

No manufacturer in a reconverting industry need obtain an individual adjustment if adoption of the industry-wide increase factor published for his industry would give him a higher price, OPA emphasized.

Profit factors for additional specific industries will be added to the first list as profit studies are completed. Subsequent applicants in those industries must use the specific industry profit factor rather than the general industry-group profit factors given in the second list. Manufacturers who have previously calculated prices, using the lower factor, will be permitted to recalculate their prices, using the new factor if it is higher.

SURPLUS SALESMAN: *W. Stuart Symington, new chairman of the Surplus Property Board, held his first press conference on the new job last week. He takes the job to the tune of criticism from Congress on the progress of surplus sales.*

Steel Workers To Demand More Points

Youngstown, Ohio

• • • While no definite demand in force has yet been made upon the Office of Price Administration, it is apparent that Mahoning Valley steel workers do not like the "discrimination" shown by OPA to coal miners in reference to the recent meat bonus declared.

Recent announcement by the OPA that coal miners would receive a meat bonus next month amounting to 50 points a month has evidently "rubbed the fur the wrong way" with the steel workers, and OPA may soon be asked to make a similar concession to this labor group. To date, complaints here have been to two boards, according to a survey. "Since when have the miners become the chosen people?" queried an irate mill worker, "anybody who knows anything about the kind of work that is demanded in the steel mills ought to know that men in the mills are just as deserving as the men in the mines."

One steel worker said he had no complaint about the miners receiving extra meat points, but said equal consideration ought to be given mill men if such "bonuses" are being passed out.

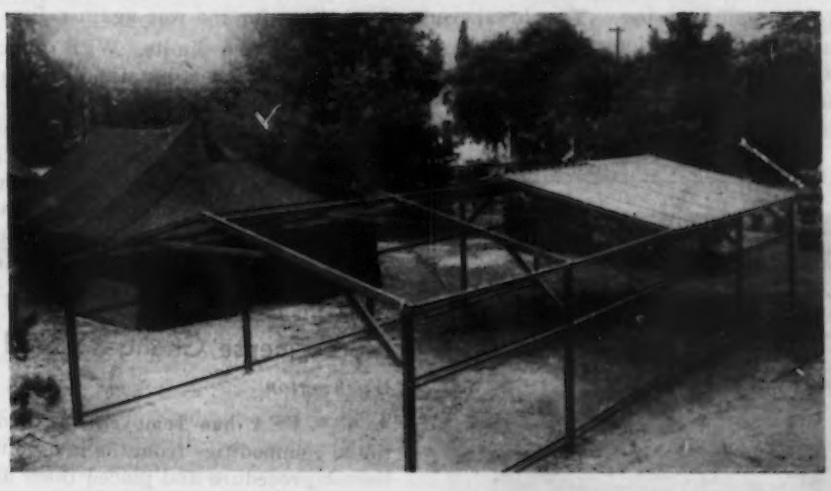
More Portable Army Squad Shelters to Be Bought

Washington

• • • The new portable Army squad shelter has been developed experimentally as a substitute for the squad tent, largely used for housing troops and for other purposes. No future procurement plan will be determined until the Quartermaster Corps has learned the results of a broad field test.

To ascertain the performance of the shelter and what changes if any will be made in specifications an award has been made (THE IRON AGE, July 12, p. 93) for 30,000 shelters, 28,000 to have minimum, 1000 to have galvanized sheet steel and 1000 to have plastic-faced plywood roofs. The disproportionate division in the award with respect to roofing material was ascribed to the large supply of aluminum as contrasted with the shortage of steel and plywood.

After a standard shelter has been devised bids will be asked for a large number. One report is that 200,000 shelters will be purchased in the fall. The shelter as now developed has been passed by the Quartermaster Board of Review.



Assuming that the tonnage is available it would appear that, based on costs, the bulk of the shelters will be steel-roofed. This is clearly indicated by the bids for the test shelters that have been awarded. They revealed that as compared with steel the costs for aluminum roofed shelters are 15.9 pct higher, while the costs for plywood-roofed shelters are 45.8 pct greater.

The shelters are delivered in standards units, 16 ft x 32 ft. The length may be varied in multiples of 8 ft by adding or subtracting bays. The frame is constructed of pressed steel. The upper portion of the walls is made of aluminum or plywood, hinged at the top to swing outward for light and ventilation, with protection from rain and sun. The remainder of the walls is canvas which, designers point out, contributes to low weight and cubage.

The weight of the 16 ft x 32 ft unit with aluminum roof is 1200 lb. With a steel roof the weight is 1500 lb. The unit, designed to accommodate 12 men, with cots, packs in a space of 24 cu ft. This amounts to 100 lb weight and 2 cu ft for each man housed, which is considered much lower than any other structure except a tent. Unlike a tent the shelter has no center pole.

The frame consists of folding bents connected by "z" shaped purlins and girts at 8 ft intervals. Each bent is made up of bat-shaped sections which fold and nest one within the other. The posts are hinged to rafters, knee braces to the posts and the rafters are hinged together at the center. The

collar-tie and the eight purlins and girts all go inside the folded bent to make a compact package approximately 3½ ft x 8 ft x 8½ ft. The knee braces and collar-tie are secured to the rafter with a unique pin connection which is operated with a screw driver and results in a permanent, easily disconnected joint, made without the use of bolts. Z-shaped purlins and girts are joined to rafters and posts by means of a T-formed end which is inserted in a slot in a rafter or post and turned approximately 45°.

Roof sheets are specially designed for the shelter, with 1⅝ ft high corrugations at 8 ft centers. This sheet, in 26 gage steel or 0.025 in. aluminum will support a uniform load of 25 lb per sq ft over 7 ft 6 in.-span. The roof sheets are secured to the shelter by sliding the lower end into a groove with a ridge cap which is held by tension from below. The bar holding the ridge cap down also braces the two upper purlins to give additional rigidity to the structure.

The shelter is extremely portable and has no loose parts, such as bolts, screws, clips or nails and average soldiers can erect one initially in six man-hours. In the second or third erection the same men can easily do the job in four man-hours.

The chief advantages attributed to the shelter are low weight, low cubage, quick erection time, good light and ventilation and a roof that will not leak, even after continued exposure.

Theoretical Picture of Size Of Reconversion and Progress by WPB

Washington

• • • WPB has issued revised figures for a selected list of 72 large, small and medium sized industries giving a theoretical picture of reconversion from full war production to partial or full peacetime production. Applying to the largest steel consuming industry, the new figures, placing present military quarterly production of the automotive industry at $2,152,500,000, fixes the minimum or breakeven peacetime quarterly rate at $620,500,000 and the "all out" or capacity rate at $1,127,400,000. Carbon steel requirements of the industry for the first quarter after operations begin at the minimum rate are estimated at 889,500 tons and at 1,648,700 tons when operating at capacity.

The cost of new construction for this industry required at the breakeven rate is fixed at $29,000,000 and for capacity rate operation it is placed at $200,000,000. Respective cost figures for equipment and tools are estimated at $50,000,000 and $150,000,000.

For all the industries the present quarterly production is estimated at $4,434,370,600 of which $3,651,860,300 is for military use. The breakeven quarterly production rate is placed at $1,453,908,000 and the capacity rate at $2,725,819,000. Carbon steel requirements, based on the minimum rate of production, are placed at 1,489,713 tons and for capacity production at 3,074,235 tons, or at the annual rate of 12,296,940 tons. Total equipment and tool requirements at the minimum quarterly rate of output are estimated at $70,313,500. Requirements at capacity rate operations are estimated at $202,537,600.

WPB pointed out that it does not prophesy when individual manufacturers will be in production or when their products will reach the market. It does point out, however, that those manufacturers who are most resourceful in seeking out idle and excess stocks, or in substituting materials that are in easy supply, "such as aluminum sheet, for those that are in tight supply, such as light gage steel sheet, are the ones who are making the most rapid progress.

Declaring that American industry has already made excellent progress toward reconversion, WPB said that war contract cutbacks are releasing sources of materials and manpower gradually and reconversion must keep pace. It cannot go faster, it was explained, than resources are released from war production without harming production for the war against Japan.

Within these limits, WPB added, progress has been outstanding, particularly among the manufacturers of passenger automobiles, electric appliances, domestic refrigerators, laundry equipment, sewing machines, vacuum cleaners, cooking and heating stoves, commercial refrigeration equipment, plumbing and heating equipment and printing and publishing machinery.

GAGES INTO HISTORY: *Early models of gages and precision instruments that made possible quality control for mass production were recently presented to the Smithsonian Institution by President Louis Polk, left, of the Sheffield Corp., Dayton. Also present were Dr. Alexander Wetmore, center, secretary of the Institution, and Lt. Gen. L. H. Campbell, Jr., chief of Army Ordnance.*

More License Changes Issued

Washington

• • • FEA has removed 151 additional commodities from the individual license procedure and placed them under general license. As a result of this action traders no longer will have to obtain an individual license before exporting these commodities or for certain other commodities up to a specified dollar value as listed in Current Export Bulletin No. 267.

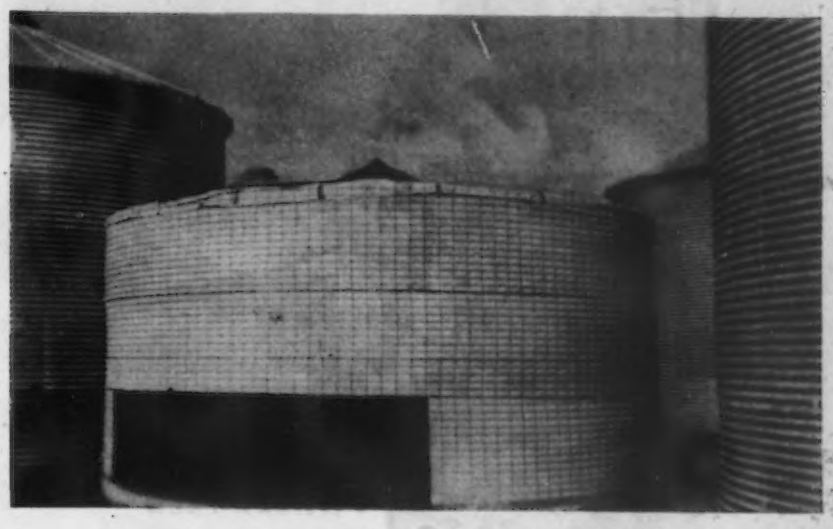
Included among the products now to be placed on general license are various steel products; iron and steel manufactures; electrical machinery and apparatus; construction and conveying machinery, and other industrial machinery.

Wire Fencing May Prove Useful For Grain Storage Bins

° ° °

By HAROLD MELVILLE PEER

° ° °



Hutchinson, Kan.

• • • **Wire fencing may** soon be in common use as material for the construction of grain storage bins. Experiments are being concluded in Hutchinson, Kan., by federal government agencies which give indication that storage bins for grain may be built of wire fencing and a few other materials combined.

The experimental project was undertaken because of the shortage of materials regularly used for the construction of grain storage bins. After much study of the proposition blue prints were drawn up for an experimental bin which was built in Hutchinson, Kan.

The backbone of this new type grain storage bin consists of welded wire fencing of standard 12 gage wire with the meshes 2 in. apart vertically and 4 in. apart horizontally. A 50-ft length of this wire fencing was made into a circular form.

Fastening the two ends together at first presented a problem but since then the American Steel & Wire Co. has made available a ½-in. high carbon wire wound into a spiral with a 1-in. pitch which easily fastened the two ends of the fencing together by simply screwing the wire spiral on when the edges are brought together. By making this spiral wire with a 1-in. pitch, and with the fencing having meshes 2 in. wide vertically, the two ends of the 50-ft length of fencing are bound once in the center of each mesh and at each edge.

This wire fencing has projecting wires about an inch in length extending all along one edge. By selecting a level piece of ground and setting up the wire fencing circular form with the edge having the projecting wires downward it is an easy matter to press the projecting wires into the ground and so anchor the circular form.

With the circular form in place it is ready for lining. This consists of 32-in. asphalt roofing with a white asbestos surface. This was used because it was felt that the white asbestos surface, put on the outside of the bin would reflect the sun rays and so make for a cooler storage bin and also reduce the insect possibilities.

In lining the bin 3-in. cuts were made into the lower edge of the asbestos surfaced roofing, each cut being about 2 ft apart. This made it possible to turn up the lower portion of the roofing lining and provide a seal for the flooring of the bin to be installed later. Where the asbestos linings ends came together a lap of 6 in. was allowed which gave a good seal with cementing the lap.

With the asbestos surfaced roofing in place as a lining for the bin, a flooring was installed. The flooring consisted of 45 lb asphalt roofing without the asbestos lining. Lengths of this asphalt roofing were cut of sufficient length to extend from side to side and allow for upturning to seal the outer edge.

Six-in. cuts were made in the ends of the strips of roofing used for the flooring. This allowed the turning up of the ends to further seal the outer edge of the bin. The various strips of roofing forming the flooring overlapped 2 in., this being considered sufficient to give a good seal. In laying in the flooring care was taken not to have the cuts in the ends of the flooring sections come over the cuts in the side lining. By having them come between, a tight seal was obtained.

With the flooring in place, the partially completed bin was filled with wheat to within 6 in. of the top of the roofing used for the side lining of the bin.

The next step was to make another section of wire fencing the same size as the first. The projecting inch lengths of wire running along one edge of the fencing and which were used to anchor the first section in the ground were used to anchor the second section onto the first. By turning some of these projecting lengths of wire inward and some outward, a good anchor was made. With the second circular form in place, another length of asbestos surfaced asphalt roofing was put in as lining. In installing this second section of lining, the lower edge was put between the wire fencing and the lining of the first section so that in case of rain, the water would not run inside the bin.

After this, more wheat was put in the bin, again to within about 6 in. of the top of the lining. Then another section made of wire fencing was put on in the same manner as the second section had been installed. Inasmuch as the lining didn't come up to the wire fencing because of being turned under at the beginning to furnish a seal, the third section of wire fencing required an extra length of lining to properly line it. With an extra length of asbestos surfaced roofing installed, the top edge of the roofing lining extended above the top edge of the last section of wire roofing. This gave lining material to turn down and form a seal at the outer edge of the roof.

The roof was made by first cutting triangular pieces of asphalt roofing unsurfaced with asbestos and lining

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these with re-enforced kraft paper cemented to the roofing. Two to three days were allowed for the cement to properly dry. When these triangular sections had properly dried, pieces of 1 x 4 in. wood of sufficient length to reach from the outer edge to the center were laid directly on the grain in such a position that a triangular section of roofing would rest on the 1 x 4's along both legs of the triangle. Adjoining triangular sections of roofing were allowed to overlap so as to form a seal.

To thoroughly seal the segments of roofing that formed the roof, lengths of window drip cap, 1⅛ x 2 in. and of sufficient length to reach from the outer edge of the bin to the center were laid on the edge of the 1 x 4's and held in place with six-penny nails driven in at an angle. Around the outer edge of the bin, the segments forming the roof were turned down and inserted between the wire fencing and the asbestos surfaced lining. In this way the contents of the bin would be protected in case of rain in which case the rain would remain outside the bin.

This completed the bin with the exception of the center of the roof. For the finishing of that a cone was made of ½-in. hardware cloth, made with a greater pitch than the pitch of the roof. A duplicate cone, made of asphalt roofing but just a trifle smaller, was then made and placed over this hardware cloth cone. By turning up the projecting wires around the edge of the base of the cone the roofing cone was securely fastened to the hardware cloth cone. The two cones were cemented together and when dry were placed in the center of the roof and fastened there with 1-in. roofing nails being driven through the double cone into every 1 x 4. This completed the storage bin.

The experimental bin has a diameter of about 16 ft and holds over 1300 bushels of wheat. It was planned and built by the cooperation of several U. S. Government agencies seeking a cheap means of storing wheat. E. R. Gross, an agricultural engineer in the employ of the federal government, was in charge of the project.

This fall the bin will be opened and the grain inspected. From information available at this time it would seem that the project will succeed and that it may mean that wire fencing will be in use for the construction of grain storage bins built along this line.

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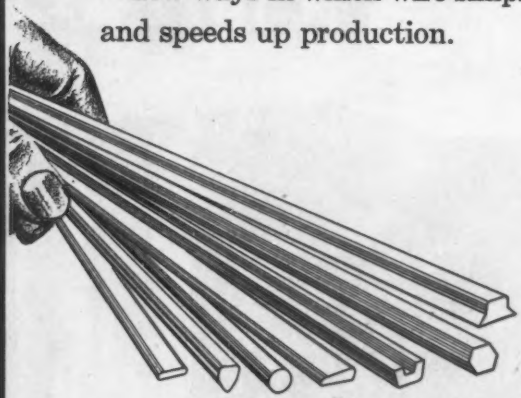

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Wardwell Warehouse Covers 92 Acres Of Space for Surplus

Warren, Ohio

• • • **An important unit** of one of the nation's largest warehousing projects for storage of surplus war property is nearing completion at Wardwell, a 92-acre site southeast of this city.

Within 30 days a central warehouse building 175 feet wide and 880 feet long, an office building, and 45 prefabricated steel sheds will be completed. The entire layout, costing over $500,000, will provide 324,000 square feet of warehouse space.

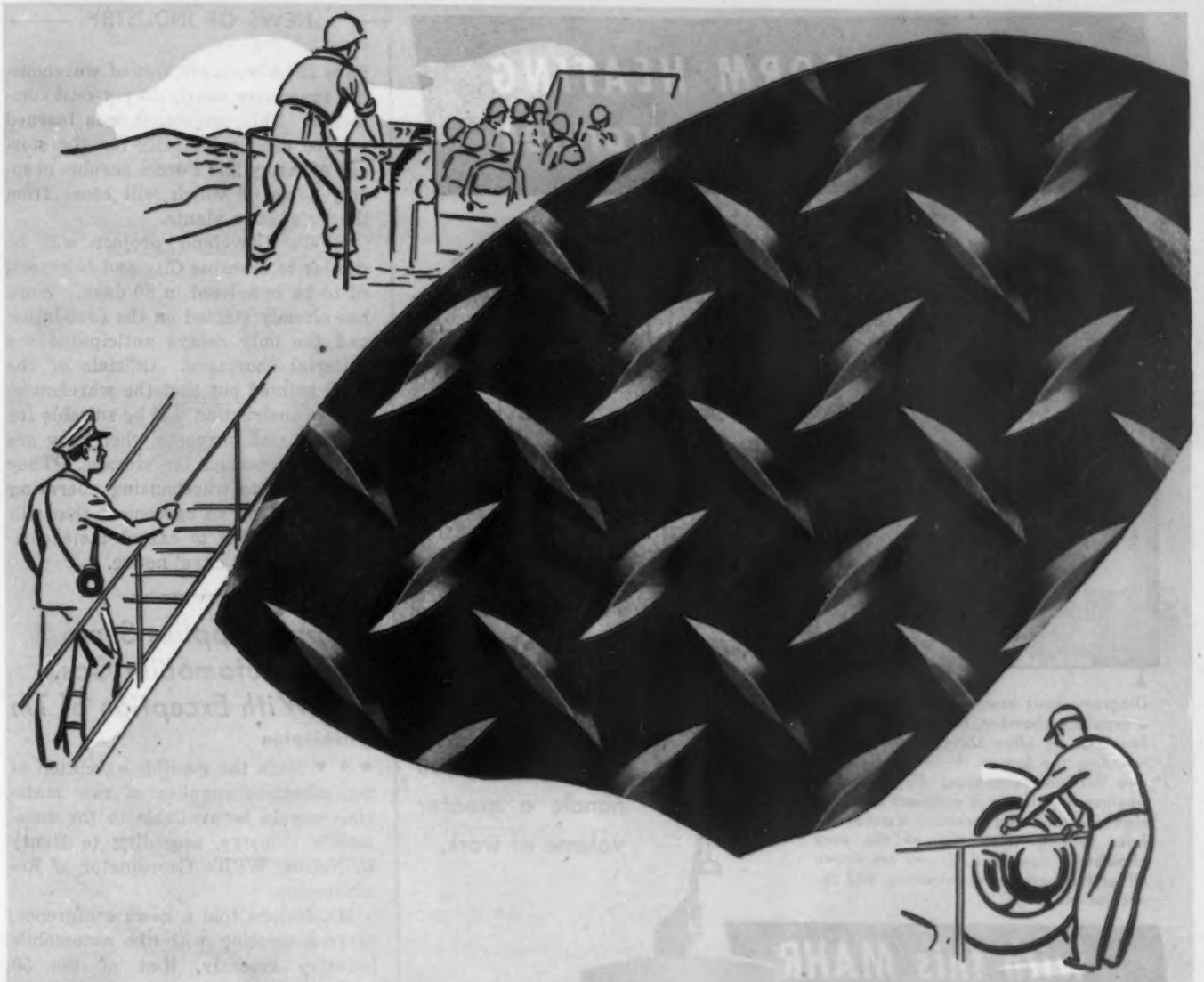
Dotting a 50-acre section the sheds at Wardwell will receive surplus war property from all of the Youngstown-Sharon-New Castle district, some from the Pittsburgh area and additional quantities from points between Akron, Canton and Cleveland. More of the acreage will be utilized as conditions warrant.

Formerly the site of the largest rubber reserve depot in the nation, the new warehouse project here is one of 31 units for the storage of surplus war property that will be located within the Fourth Federal Reserve District. In Ohio alone there will be 28, most of them much smaller than Wardwell.

Much of the property to be received here will be heavy machinery and the products of war plants not currently needed and other surplus material that has been used or superseded by later models or different needs. This property will be held for storage and ultimate disposal by sale or other military use. Preliminary plans have been made for an office and showroom for the sales staff of the Reconstruction Finance Corporation, under whose sponsorship these warehousing projects are being constructed, and construction of the Warren showroom will start within two weeks.

With 16 of the 31 warehouses now in operation, the RFC announced that cost of three of them totaled more than $1,800,000, including Wardwell, Moraine City and the Clark Street project in Cleveland. All units have been designed to have a definite salvage value when RFC no longer needs them.

In Canton surplus material will be stored in a building built for the Republic Steel Corp., and the Diebold Plant which is now being repaired. Moraine City, a Dayton suburb, will



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An engineer in a power plant . . .

A stevedore on a loading platform . . .

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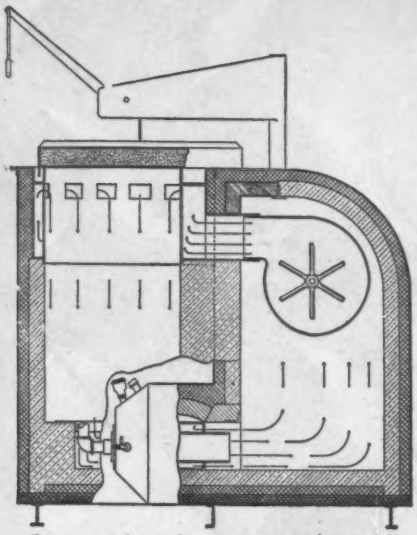

Diagram shows how gases are heated in a separate chamber, then forced by the fan into an alloy distributor ring surrounding the top of the work chamber, and through the charge. Regardless of whether the charge is compact or loose, high velocity and pressure assure uniform heating. Flow through the work chamber is downward. Gases are drawn off at the bottom for reheating and recirculation.

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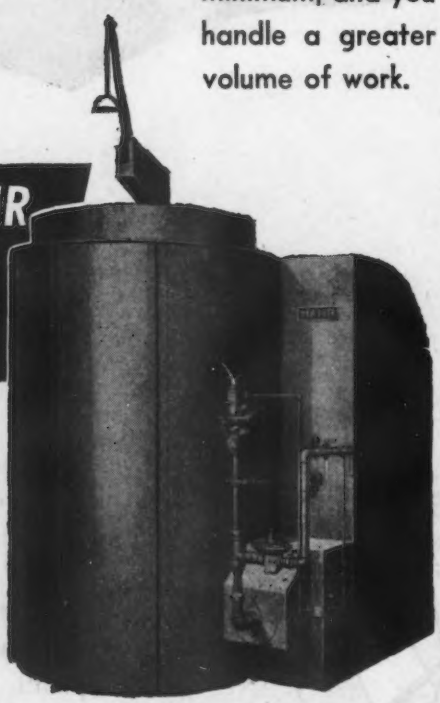

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have 257,500 square feet of warehousing space now nearly 50 per cent completed. This project, it was learned will be used principally for the storage of Army Air Forces surplus property some of which will come from the Frigidaire plants.

RFC's Cleveland project will be similar to Moraine City and is expected to be completed in 80 days. Work has already started on the foundation and the only delays anticipated are material shortages. Officials of the RFC pointed out that the warehouses under construction will be suitable for a number of purposes when they are no longer needed for storage. They will be let to warehousing operating contractors on an agreement that will allow the RFC to cancel their commitment on 30 days' notice.

Enough Supplies Seen For Automobile Cos. With Exception of Tin

Washington

• • • With the possible exception of tin, adequate supplies of raw materials should be available to the automobile industry, according to Henry P. Nelson, WPB's Coordinator of Reconversion.

Mr. Nelson told a news conference, after a meeting with the automobile industry recently, that of the 50 orders affecting reconversion of the auto industry only five were still classed as serious problems.

The materials covered by these five orders and their availability to the auto industry are:

1. Tin, which may be used for radiators, bearings and other normal uses, but may not be used for body solder or plating of pistons. A substitute has been found for piston plating and the industry has told WPB that it probably would be able to find a substitute for tin in body solder. Tin is the most serious shortage and Mr. Nelson pointed out that adequate supplies may not be available to meet increased automobile schedules next year.

2. Antimony, used as a substitute for tin in many cases, is also in short supply. However, if substitutes are found for tin, where required, this shortage will not be serious.

3. Cadmium, although extremely short at the present time, can be substituted by other materials, according to WPB. Cadmium is used by auto manufacturers primarily for plating.

4. Chromic acid shortages will effectively prohibit the use of chrome

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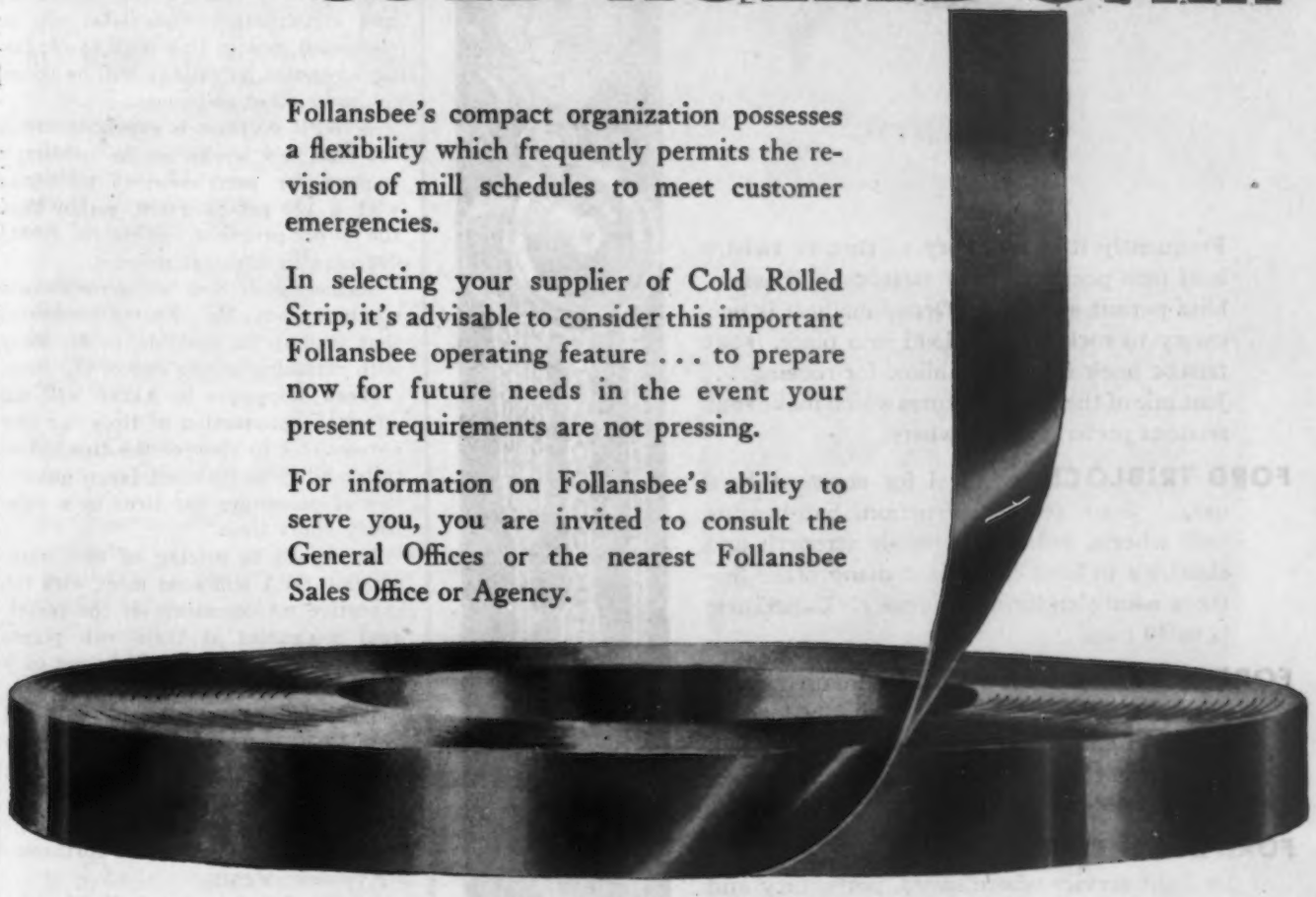

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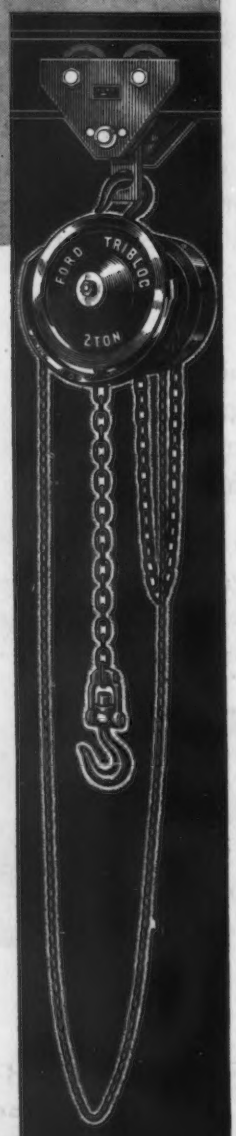

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plating for decorative parts. Chrome plated functional parts will be permitted. Mr. Nelson said that nickel may be used for decorative parts.

5. Acute shortages of burlap and cotton linters will not trouble the auto makers. The industry uses less than 1 pct of the nation's textile output and substitutes will be available.

In regard to sheet steel, Mr. Nelson said that very little sheet tonnage was being delivered on unrated orders at present, but indicated that the situation would ease within the next 60 days, largely because of the recently invoked inventory regulations and checks being made by WPB of cutbacks with producers and at the mills. Mr. Nelson also said that if 2800 additional workers could be properly placed in the steel industry the sheet and strip situation would soon be eased permanently.

The AA-3 ratings for machinery and construction materials will be continued, but in line with the industry's request no ratings will be issued for production materials.

A WPB decision is expected within the next few weeks on the industry's request for permission to go ahead with a 100 pct program, rather than the 50 pct program, calling for 2,000,000 cars in effect at present.

Rationing of new automobiles will continue, but Mr. Nelson indicated that it may be possible to do away with rationing at the end of the year.

Work stoppages in Akron will not affect the production of tires for new automobiles in view of the tire industry's ability to turn out large quantities of passenger car tires in a relatively short time.

In regard to pricing of new automobiles, OPA will soon meet with the executive managements of the individual companies at their own plants indicating that prices will be set on a company basis.

The automobile industry will not experience nearly as difficult a situation as now confronts it with respect to steel sheets in the procurement of the grey iron and malleable castings required for construction of forthcoming passenger cars.

Captive foundries controlled by the manufacturers, WPB officials say, will overcome whatever preliminary bottlenecks that may arise in the early stages of reconversion manufacturing. Those manufacturers not having such facilities available for their use may, encounter some trouble. This is particularly true of the manpower problem which is of primary importance at this time.

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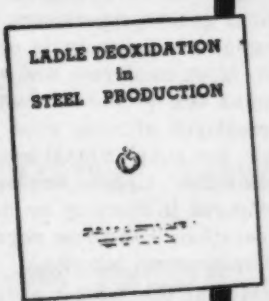

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Extra Miner Ration Plan About to Be Set in Operation

Washington

• • • **The program for providing extra food rations to coal and ore miners, announced by Chester Bowles, Price Administrator June 30 and now being tested in the Rocky Mountain mining area, will be extended to include miners in other sections of the country during the first week of August, it has been announced by Max McCullough, deputy administrator for rationing of OPA.**

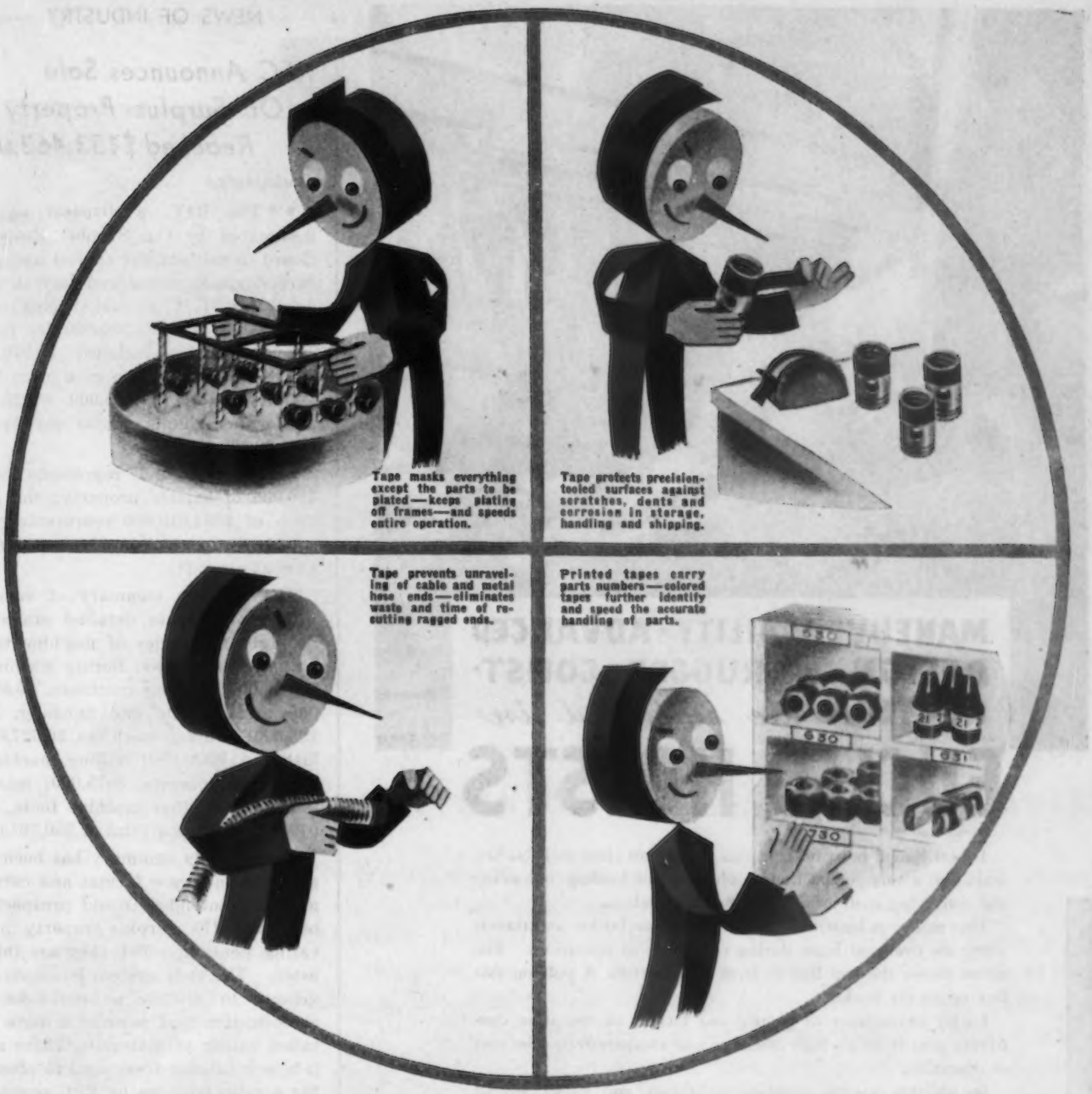
Groups already provided with additional rations together with coal and ore miners, account for most heavy industrial workers who do not have access to in-plant feeding establishments. It is not planned to provide additional individual rations to workers in heavy industries who have access to in-plant, restaurant or other group feeding arrangements. Instead, these workers may be provided with additional food through their in-plant cafeterias or restaurants.

Coal and ore miners, to be eligible, must be employed at the site of mining operations, must be engaged in heavy work that requires continuous exertion of muscular strength and must not be served food by in-plant feeding establishments.

In general, all those employees who work underground are eligible for extra rations except supervisors who do not engage continuously in strenuous labor. Most employees who work above ground are excluded. Surface workers employed at mine sites who are eligible for supplemental rations are blacksmiths, tipple employees, persons engaged in foundry or metal casting operations and those engaged in heavy construction labor.

OPA said that the mining workers not included in the groups eligible for the extra rations generally are able to meet their requirements with increased use of non-rationed foods and without supplemental rations.

Miners who qualify for extra rations will be eligible to obtain not more than 1.7 red points for meat-fats for each day they work and one pound of sugar each month, in addition to the meat-fats and sugar they can get with the stamps in their War Ration Book Four, OPA said. The maximum number of supplemental red points a miner can get in any one month is 50, regardless of the time he works.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RFC Announces Sale Of Surplus Property Reached $133,462,000

Washington

• • • The RFC, a disposal agency designated by the Surplus Property Board to sell surplus capital and producers' goods, announced July 16 that as of May 31, it had sold surplus property valued at $235,380,000 for $133,462,000. Sales included $5,970,000 worth of steel, whose cost price was $9,265,000, and $1,865,000 worth of nonferrous metals whose cost price was $2,799,000.

Surplus "on hand" represents $535,786,000 of salable property; the balance of $934,618,000 represents nonsalable property (mostly non-flyable combat aircraft).

The monthly summary of surplus property presents detailed statistics on eight categories of machine tools on hand, as follows: Boring machines, $8,050,000; drilling machines, $5,820,000; gear-cutting and finishing, $2,103,000; grinding machines, $6,627,000; lathes, $11,920,000; milling machines, $8,187,000; planers, $975,000; miscellaneous and other machine tools, $7,079,000, making a total of $50,761,000.

The monthly summary has been redesigned in a new format and carries an index intended to aid prospective buyers of RFC surplus property in locating items in which they are interested. The code system has been developed to provide a breakdown in classification that permits a more detailed listing of materials. There also is a new tabular form used to present the surplus holdings by RFC agencies, of which there are 31 located strategically throughout the nation.

National Steel Corp. Reduces Indebtedness

Pittsburgh

• • • National Steel Corp. has completed a program which reduces the debt of the company by $14,500,000 and eliminates the requirement for sinking fund payments for a period of 13 years, it was announced today by E. T. Weir, chairman.

The $14,500,000 debt reduction was achieved by the payment in advance of National Steel Corp.'s outstanding serial notes amounting to $4,500,000 and by the purchase of $10,000,000 of its 3 pct first mortgage bonds, which have been delivered to the trustee

HEADQUARTERS FOR ENGINEERED CUTTING TOOLS

A *Must* IN THE PRODUCTION OF ILLINITE CUTTING TOOLS

To prevent decarburization or oxidation, a chemically balanced atmosphere is maintained in the high speed steel furnaces where ILLINITE Cutting Tools are hardened. This is an excellent example of the great care that is taken at every step to give you tools of the highest quality. But, Illinois Tool offers even more . . . an experience of thirty-two years in helping the leading industrial firms of America solve their metal cutting problems. Consult an Illinois Tool engineer—let him help you gain the benefits of ILLINITE Cutting Tools—specially engineered for your particular application!

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This Old Machine Made Useful at Low Cost . . .

by replacing worn-out assemblies with stock-model Delta units

A money-saving idea on retooling — typical of practices proven sound by war-production experience:

1. Use standard, low-cost Delta components to build high-production, special-purpose machines — quickly convertible to other uses when requirements change.
2. Modernize your present machines that are rapidly approaching obsolescence, by replacing worn elements with regular, stock-model Delta units.
3. Utilize the portability and compactness of Delta-Milwaukee Machine Tools, to revise or supplement production-line layouts for increased man-hour output.

This is representative of results in hundreds of plants which have employed Delta's modern, flexible approach to tooling—on a wide variety of operations.

Delta's savings in cost, weight, and space are not obtained at the expense of quality. They result from advanced design and from quantity production of standard models.

Perhaps a study of the versatility of Delta-Milwaukee Machine Tools may suggest ways of cutting *your* investment risk in retooling. Investigate Delta's advantages.

Delta MILWAUKEE Machine Tools

● The above illustration shows a multiple-spindle drill press that The Coleman Lamp and Stove Co., Wichita, Kansas, modernized with standard Delta components — at a fraction of the cost for a new machine.

The original heads of the old machine were worn out to the point of having only junk value. These were replaced by three Delta 17" drill press heads mounted on the original base and table which were still in good condition. Thus, an obsolete machine was economically salvaged and production capacity increased.

MA-22

Delta's 76-page Blue Book provides 140 case histories of war-production experience, to help you more clearly visualize the flexibility of portable, compact Delta-Milwaukee Machine Tools. Also available is a catalog of these low-cost machine tools. Request both, using coupon below.

Tear out coupon and mail today!

THE DELTA MANUFACTURING CO.
704H E. Vienna Ave., Milwaukee 1, Wis.

Please send my free copies of Delta's 76-page Blue Book and catalog of low-cost machine tools.

Name_____

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under the indenture for application to sinking fund requirements.

The serial notes, which bore interest ranging from 2⅛ pct to 2⅜ pct, and which would have matured at the rate of $1,500,000 per year in 1946, 1947 and 1948, were called for payment on June 30, 1945, under the terms of the indenture.

The indenture covering the 3 pct bonds requires sinking fund payments of $1,250,000 per year, commencing in February, 1950. Application of the $10,000,000 of bonds just purchased covers the sinking fund requirements up to 1958.

With the completion of this transaction, the total remaining funded debt of National Steel Corp. has been reduced to $40,000,000, all of which consists of the 3 pct first mortgage bonds.

National Steel Corp. has no preferred stock issue, its only capitalization being 2,206,492 shares of common stock.

Reconversion Causes Shortened Work Week

Cleveland

• • • **Reconversion in this area** is progressing quietly, but only in the slightly shorter work week is it becoming apparent that the production pace is slowing down, according to J. W. Vanden Bosch, analyst of the Cleveland Chamber of Commerce.

In his monthly survey, Mr. Vanden Bosch found that 100 representative companies showed a loss of only 618 workers during the month of June, compared to a drop of 2100 in May, 1470 in April and 1620 in March. However, the average work-week decreased to 49.2 hours in comparison with 49.6 hours in May and 50.4 in March, World War II peak.

Based on the 1939 average, the index of employment was 178.8 in June, compared to the wartime high of June, 1943, which was 199.6.

Permission Extended

Washington

• • • **Permission** for the Army and Navy to make direct allotments of steel to forgers making shell steel forgings on Army or Navy subcontracts was extended through the fourth quarter of 1945 on July 10 by WPB.

Directon 64 to CMP Regulation 1, previously had an expiration date for direct allotment to forgers of Sept. 30, 1945, the end of the third quarter.

Steel

New Y

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Steel Construction Official Outlines Reconversion Points

New York

• • • **Interest is being focused by all segments of industry today on the methods and procedures undertaken by government agencies in preparing for full reconversion from war to peace activities according to L. Abbett Post, manager of the American Institute of Steel Construction. The question in everyone's mind is: "How can full reconversion be attained without jarring the economic structure of the country?"**

To arrive at conclusions that will serve the greatest number of people is the duty, naturally, of our government leaders, and their success will be predicated to a large degree on the open-mindedness of their decisions, he said.

The structural steel fabricating industry has a large stake in the future, and the actions of government groups, as well as of private influences, have now begun to shape up in such a way that a "balance sheet for 1945-1946" might develop some interesting data.

In attempting to set down the facts, as they now appear, Mr. Post has drawn up a form of balance sheet, as follows:

Assets

1—WPB controls are being relaxed or revoked as rapidly as circumstances permit. WPB is watching the "war effort" only, and has no plans for self-perpetuation.

2—Financing for much "postwar" construction is now available for both private and public works.

3—Construction plans are now ready for much private and public works, and surveys show that there is a vast accumulated demand for all types of construction.

4—Structural steel will undoubtedly be available for unrated orders, at least by the first quarter of 1946. In the meantime, through the "open-ending" of CMP, fabricators may order steel from producers on unrated orders but will only receive deliveries after the mills have filled all rated orders.

5—Labor and management are exerting strong efforts to cooperate in such a way as to preserve a strong economy after the war.

Liabilities

1—OPA controls are certain to remain until July 1, 1946, and might last much longer. As long at OPA sticks to an unyielding "hold-the-line" policy on prices, there will naturally result a discouragement of new production with its resulting employment.

2—Labor and wages controls seem to continue with only slight relaxation, and these have been ineffective in overcoming local labor shortages as well as strikes.

3—Material shortages on many construction items such as lumber, brick and gypsum lath undoubtedly will slow up residential construction, as well as industrial work. Galvanized sheets used in duct work for air conditioning will probably be scarce for some time.

4—Equipment shortages may continue for some time, making it difficult for groups planning construction schedules. The makers of boilers, refrigerators, air conditioning and other products vital to new construction have been given virtually no indication as to when material will be available for civilian production.

5—Labor scarcity is a difficult problem at the present time and is likely to continue as such for a while. Readjustment, especially of wages, to a normal peacetime basis is a serious deterrent to the revival of construction.

Balancing the above assets and liabilities, it appears that there will undoubtedly be some delay in the pickup of construction during the next year, but after that the industry can look forward to an extended busy period.

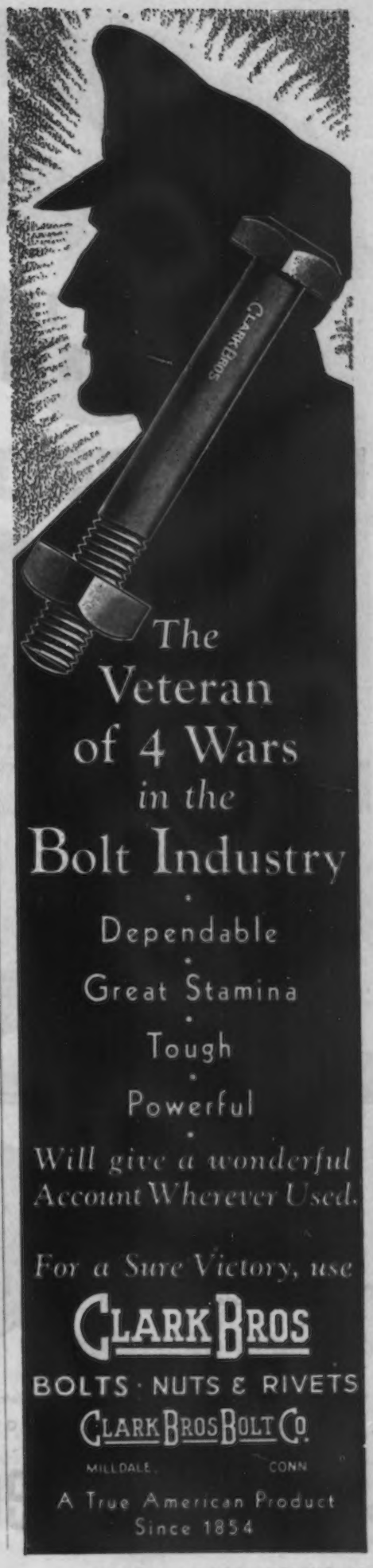
Ordnance Plant To House Mental Cases

Columbus, Ohio

• • • **Reconversion of the Scioto Ordnance plant, from incendiary bombs to inmates, was announced by State Welfare Director, Frazier Reams, who recently said that he would try to lease a part of the Ordnance plant to house 2500 mentally ill persons in state institutions which are 30 pct overcrowded.**

Following a conference with Gov. Frank J. Lausche, Mr. Reams told reporters: "The setup is good; it's the greatest gleam of hope I have had for bridging the gap until we can get new hospitals built. The whole plant could be ready for use within 60 days after we took control at a cost of no more than $5000 to $10,000," he added.

According to Mr. Reams, some of the buildings are not being used for ordnance purposes and are now housing German prisoners of war from Camp Perry and their guards.



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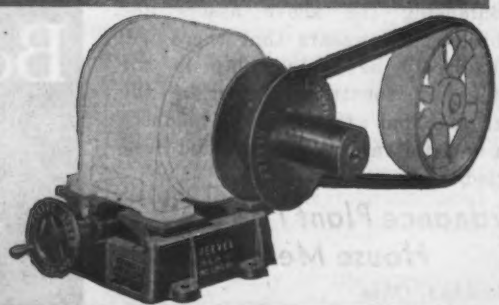

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REEVES Speed Control

New Contract For Latest Target Plane

Buffalo

• • • **Bell Aircraft Corp.** has started production on a new contract for RP-63G armored fighter planes for the AAF Training Command. An improved version of the original RP-63s, developed for simulated combat training of flexible gunners, it will soon be in production.

The original contract was for 300 planes—RP-63A-11s, RP-63A-12s and RP-63C-2s — and the new schedule calls for a substantial increase in number to be built through June 1946.

The new RP-63s (R = restricted from combat) have a heavier covering of armor, increasing the thickness from three-sixteenths and one-quarter of an inch to dimensions of one-quarter to five-sixteenths of an inch.

Whereas gunners were restricted to shooting at the original RP-63s from within a thirty degree angle each side of head-on, the new planes can be fired at from any angle. Four additional spotlights have been installed as compared to the single nose lamp on the first target planes, and an improved type hit indicator developed by Bell engineers replaces the original hit recording system.

C&O Trains to Be Built by Budd Co.

Cleveland, Ohio

• • • **Two streamlined stainless** steel trains that will inaugurate after the war a fast daylight service between Washington and Cincinnati have been ordered from the Edward G. Budd Mfg. Co. of Philadelphia, by the Chesapeake and Ohio Railway Co., Carl E. Newton, C. & O. president, announced here this week.

The trains will be built in the Budd Company's new railway car manufacturing plant in Philadelphia and will be powered by a type of coal-burning steam-turbine electrically driven locomotive, three of which are now under construction.

According to Mr. Newton, the recent diplomatic specials which were run from Washington to the San Francisco Conference in three and one half days, without changing cars demonstrate the practicability of a through trans-continental passenger service in the post war period. The new equipment, now on order, is expected to establish new standards of comfort, luxury and all-around appeal to the traveling public.

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Smithsonian Institute Receives Four Early Model Instruments

Dayton, Ohio

• • • Four early models of gages and precision instruments that have revolutionized quality control of mass production were presented to the Smithsonian Institution, Washington, D. C., July 16, by Louis Polk, president, The Sheffield Corp., Dayton, Ohio.

In his remarks, Mr. Polk called attention to the importance of gages, which assure efficient interchangeability of parts and proved so vital in the war program. Wresting world leadership for the production of precision instruments from the once famous Zeiss factory of Germany is a major accomplishment of American gage manufacturers. Fortunately, this leadership was secured before the outbreak of hostilities; otherwise, this country would have faced a tremendous handicap in the production of war materials in either the necessary quantity or quality.

One of the most interesting of the gages presented to the national museum is the first Sheffield shell Multichek, a multiple electric gage that checks a number of critical dimensions simultaneously. Tolerance is adjustable and is accurate within ten-millionths of an inch. It signals by a series of electric lights, all integrated into one master light. Individual lights show incorrect dimensions with red indicating undersize and green, oversize. This particular instrument was installed at Frankford Arsenal in 1940. From that time until the middle of 1944, it inspected 5,815,665 37 mm shells, a total of 29,078,325 dimensions, and saved more than 4000 days of work over previous hand gaging methods. Approximately 122,000,000 37 mm shells have been manufactured since the beginning of the war, and most of them were inspected with these multiple electric gages, so that over one billion individual dimensions were checked, with a tremendous saving of work. The Multichek is being used in checking a great variety of products in addition to shells.

Another gage in the collection is the first Precisionaire, used in a General Motors plant until a few weeks ago. It is a flow type air gage for rapid and accurate measusing of internal diameter, bell mouth, out-of-round and average diameter, as well as outside diameters.

The instrument has an almost unlimited range of applications, including the use of multiple tubes for inspecting several diameters simultaneously. Some current models are capable of checking tolerances to plus or minus five-millionths of an inch.

An early model Visual Gage is the first comparator using the frictionless reed mechanism and light beam lever arm to be made in the United States. It was used for many years at the Ford Motor Co. in Detroit.

Gages such as this are used for checking master and production gages, purchased parts, work in process and final inspection, for toolroom, laboratory and research work. Visual Gages range from 500 to 1 to 20,000 to 1 magnification, the latter model being graduated in units of two-millionths of an inch. If it were possible to split a human hair into 2000 equal parts, this gage could accurately measure the diameter of one of the parts. It is so sensitive it will measure the expansion of metal when warmed by the touch of a human hand.

The fourth gage in the group is an early model Electrichek, the first commercial comparator using electric signal lights. It shows by means of colored electric signal lights whether a dimension is within tolerance, oversize or undersize. This is an extremely rapid inspection instrument for production work, and it is accurate in checking either tolerance limit to within ten-millionths of an inch. The Smithsonian instrument was sold to Reo Motors in 1929 and remained in use there until a few weeks ago.

Industrial leaders say the wartime developments in industrial methods and equipment, such as low cost control of high quality in mass manufacturing, will help provide many better peacetime products. Due to the war, this country has been geared to production on a quantity and quality basis never achieved before. It is hoped this will mark the beginning of an era that will result in many present day luxuries becoming everyday conveniences within the reach of everyone.

FOR ALL TYPES OF INDUSTRIAL FURNACES

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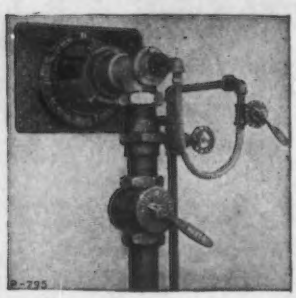

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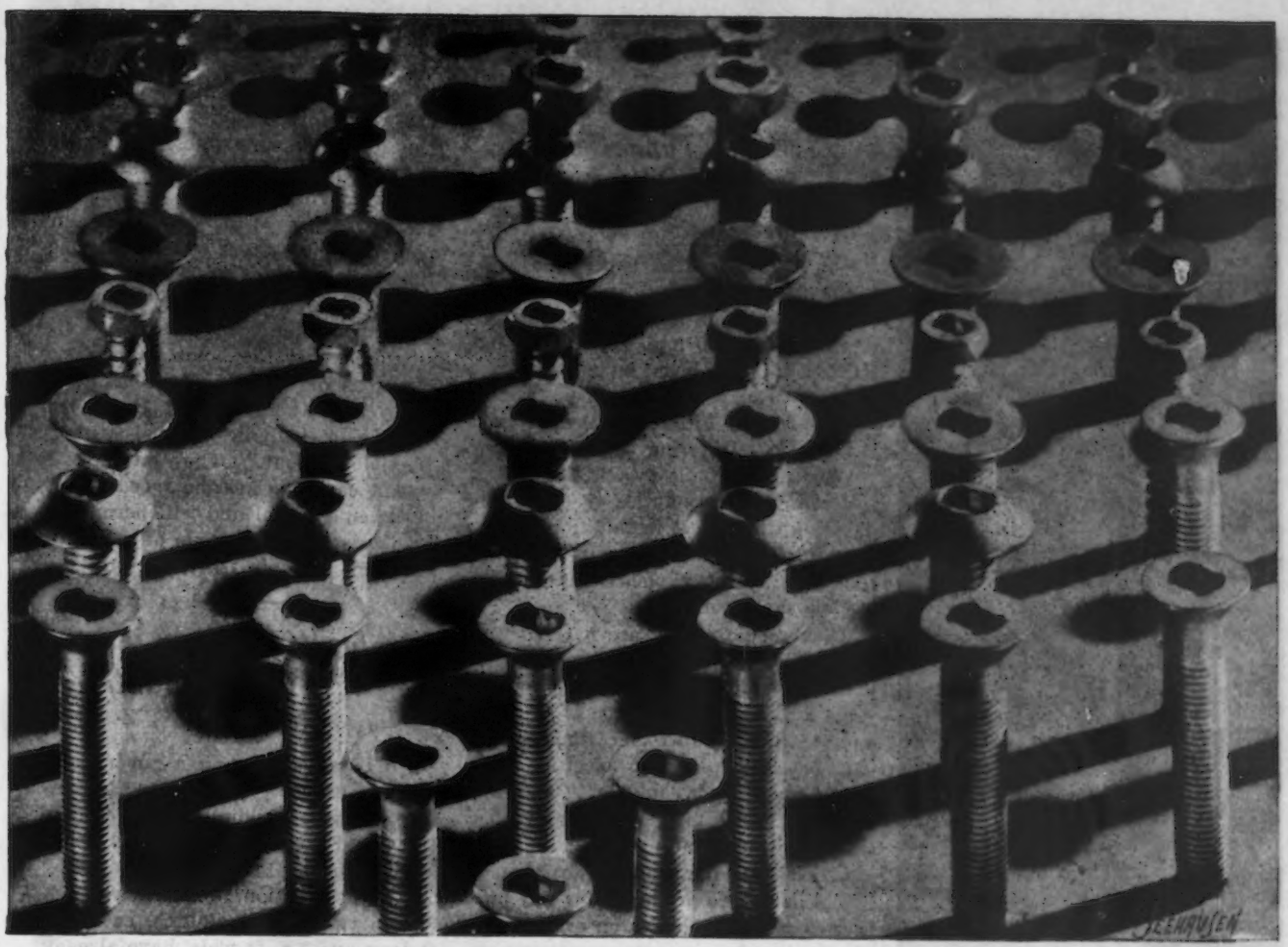
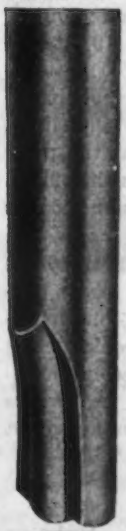


TYPE "A" ASSEMBLY BIT



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CLUTCH HEAD LOCK-ON SOLVES MANY PROBLEMS
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REMOVES SCREWS UNDAMAGED
AND SAVED FOR RE-USE

THE ONLY MODERN SCREW BASICALLY DESIGNED

CLUTCH HEAD SCREWS

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SAMPLE BIT AND SCREWS SENT ON REQUEST

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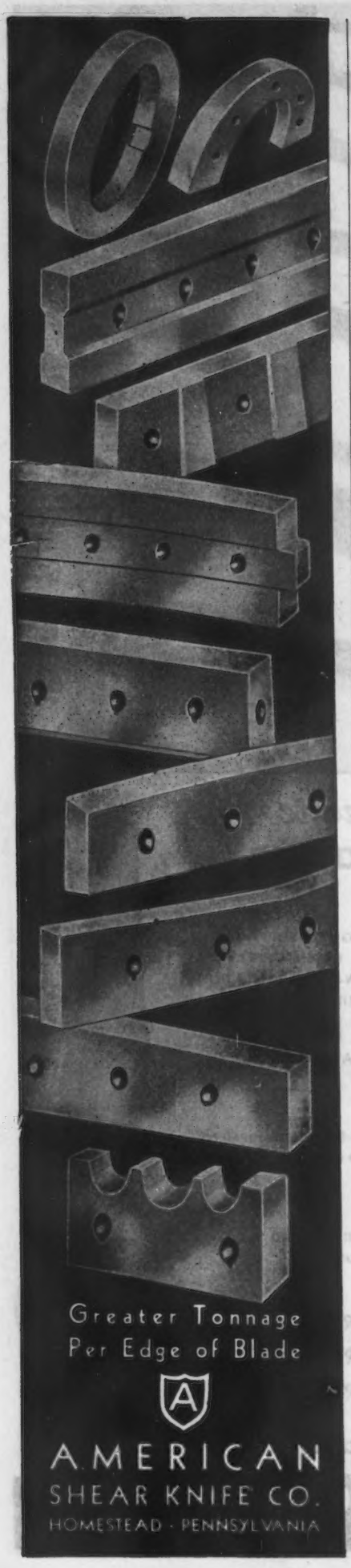


New Type Supersonic Wind Tunnel Built By Pgh.-Des Moines

Pittsburgh

• • • The largest supersonic wind tunnels in existence, for testing ordnance materiel in air velocities exceeding the 750 mph speed of sound, recently have been built for U. S. Army Ordnance at Aberdeen Proving Ground by Pittsburgh-Des Moines Steel Co. Differing from the many wind tunnels built by Pittsburgh-Des Moines for aeronautics research and testing, this latest installation is used for testing bombs, various types of rockets, artillery shells and similar ordnance materiel.

Supersonic speeds are necessary to measure the flight of projectiles, which even in ordinary artillery weapons often travel in excess of 1800 mph. These supersonic tunnels now produce equivalent air velocities up to 1300 mph, and equivalent velocities of over 3000 mph will be obtained in the near future.

Although the supersonic tunnels were developed primarily for war purposes, Aberdeen research experts believe they have great peacetime possibilities, such as developing superior airplanes, especially the jet propelled type.

According to Army engineers, the first tests in the supersonic tunnels far more than repaid their cost. A new bomb design, for which an urgent frontline call had been received, was found to require changes by a test in the tunnels.

One projected military use of the supersonic tunnels was disclosed by Lt. Gen. Levin G. Campbell, chief of Army Ordnance, who declared at the official dedication that they would be used to help develop the "guided missile" or robot bomb. Rockets, bullets, artillery shells, and every type of projectile or object which encounters air resistance, can be tested.

For production of supersonic cyclones, it is necessary to dry and compress air at pressures up to 160 lb, then force it through a narrow opening or "throat" which widens sharply, thus creating very high speeds. In an engine room which in size compares to that of a large ship, the 13,000 hp required to drive the air compressors that operate the tunnels is generated.

A model of the bomb, rocket or projectile to be tested is supported in this high speed air on the end of an arm which is part of a balance system capable of very accurately measuring the wind forces on it. At the same time air pressure lines, similar to those formed on the water surface by a fast moving ship, can be seen and photographed with a "Schlieren" photographic system which takes pictures at speeds of 0.000004 sec.

The installation actually comprises two supersonic wind tunnels in a single layout; the bomb tunnel now in use is of the "fixed throat" type, while the other, not yet completed, will be a ballistics tunnel with a "flexible throat." The latter will permit variation in wind speed simply by turning a dial and will permit reproduction of the speeds of a missile at every point in its trajectory.

Surplus Warehouse Being Established

Chicago

• • • Establishment of a government surplus property warehouse, consisting of three buildings on a 41-acre tract in East Chicago, Ind., is under way, according to plans announced by the Reconstruction Finance Corp.

Two two-story buildings, each 500 ft long and 225 ft wide, have already been constructed, while bids on a third building, 1200 ft long and 300 ft wide, were received July 19 at the RFC office here.

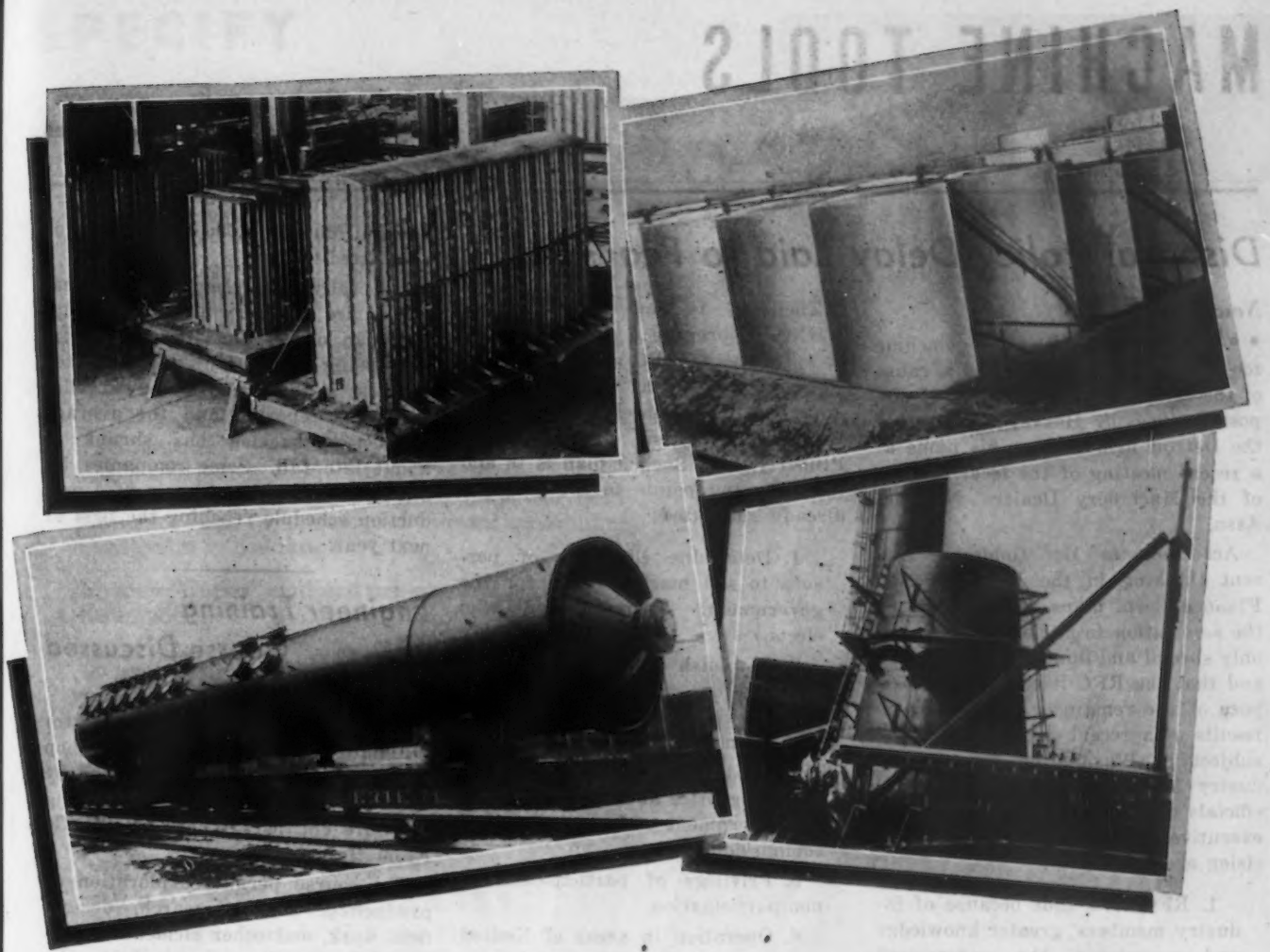
Durable goods, such as machinery, machine tools and other industrial equipment, will be stored at the projected warehouse, E. R. Smith, official with the warehouse division of the RFC, said.

Originally purchased in 1942 by the DPC the site was intended for an ordnance plant. At that time, one building was erected and construction started on a second. The second building was completed about two weeks ago after plans for the ordnance plant had been abandoned.

Kelsey Hayes Plant for Sale

Washington

• • • The RFC is offering for sale the industrial plant at Plymouth, Mich., now occupied by the Kelsey Hayes Wheel Co., which is engaged in the manufacture of war materials. Negotiations for its sale have been started and other companies or individuals interested in negotiating for its purchase or lease should, prior to Aug. 20, contact the RFC Detroit regional office, Surplus Property Division, 607 Shelby Street, Detroit 26.



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MACHINE TOOLS

. . . News and Market Activities

Disposal Policy Delay Laid to Fear

New York

• • • Government fear of machine tool dealers was specified as a cause of the delay in the formulation of disposal policies by Harvey Goldman, of the Detroit firm bearing his name at a recent meeting of the local chapter of the Machinery Dealers' National Assn.

According to Mr. Goldman, current thinking in the Reconstruction Finance Corp. plans for members of the association to be permitted to sell only special and limited purpose tools, and that the RFC itself plans to dispose of the remainder. According to results of a recent conference on the subject in Washington between industry leaders and ranking surplus officials the guiding thoughts of RFC executives in coming to the above decision are as follows:

1. RFC feels that because of industry members' greater knowledge and experience, the government would not be able to properly control this disposal problem.

2. Government fears that the industry would sell the better standard tools, which RFC feels that it can sell without help, and leave the government stranded with limited purpose and special equipment.

3. RFC is afraid that the dealers would buy and sell or traffic in government owned tools to the disadvantage of the government and the program.

4. RFC is genuinely afraid that the dealers will undersell the government with the floating inventory of privately owned tools.

The overall MDNA program which had already been submitted to disposal officials was also discussed in the meeting, and Mr. Goldman stated that government officials are willing to cooperate in the establishment of a tool disposal policy utilizing the services of the dealers, rebuilders, auctioneers, and brokers in the industry. Mr. Goldman pointed out that it is the feeling of the industry that assistance can thus be rendered to the government in inventorying, listing, appraising, scrapping, selling, and warehousing.

The way is now clear for the MDNA to prepare a specific plan to be submitted to RFC and the Surplus Property Board that will protect the government adequately, and comply with the provisions of the Surplus Property Act. Such a plan is to add the following points to the program already submitted:

1. Determine eligibility of persons to sell machine tools for the government. (Any dealer who elects.)

2. Establish a dealer's responsibility.

3. Develop a method of invoicing and payment of commissions.

4. Find method of maintenance of selling price to be determined by the government with predetermined commission.

5. Privilege of participation or non-participation.

6. Operation in areas of limited and special tools, with special privileges of dealers to purchase for rebuilding or stock.

7. Cover the question of a dealer's interest in two or more concerns and in combination dealer's activity.

Machine Tools to Be Shown

Chicago

• • • More than 1000 used machine tools and miscellaneous equipment will be displayed by the Reconstruction Finance Corp. at its Hammond, Ind., warehouse Aug. 6 through 11. Included are boring mills, conveyors, drill presses, furnaces, gear shapers, grinders, lathes, lens grinding machines, milling machines, pickling units, motor generators, planers, and riveting machines.

Big Postwar Plan Seen

Cincinnati

• • • Recent survey of this area by the local Chamber of Commerce indicates a $33,000,000 postwar construction equipment, and retooling program. A number of large local companies are included in this list and a General Motors $2,500,000 program is also listed.

Generally inquiries for new machines are still very active, but shipment on orders for reconversion is still being delayed by higher rated business in this area. Some cancellations are reported and the average production backlog has shrunk to about late fall. Some companies indicate their backlogs represent a production schedule reaching the first of next year.

Engineer Training Course Discussed

Milwaukee

• • • A two-year training course for graduate engineers embracing shop and office work has been outlined by Allis-Chalmers Mfg. Co. in a training brochure entitled "Where Do We Go From Here."

The course permits exploration of production, sales, research, design, field work, and other elements of industrial operation. In applying the plan, the engineer is given great flexibility in laying out his course. After discussion of experience, aptitudes, and preferences with an experienced advisor, a training schedule with a related sequence of jobs is projected.

Recently inaugurated, an Allis-Chalmers program of graduate study in cooperation with the Illinois Institute of Technology is also discussed in the booklet.

Buffalo Employment Down

Buffalo . . . Factory employment in 173 area plants was slashed nearly 10,000 in June to the lowest level since April, 1941, the Buffalo Chamber of Commerce reports. Payrolls also dropped, but average weekly earnings of individual workers gained.

The June employment figure was 95,561, a decrease of 8.7 pct from May and of 20.8 pct from June of 1944. Average weekly payrolls of the 173 plants last month were $5,251,108, against $5,621,717 in May and $6,427,576 in June last year. Average weekly earnings amounted to $54.95 in June, compared with $53.73 in May and $53.29 a year ago.

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NON-FERROUS METALS

. . . News and Market Activities

Controls Eased On Aluminum

Washington

• • • Issued by WPB on July 24, Direction 25 to CMP Regulation 2 lifts inventory restrictions on users of aluminum in all forms and shapes, except extrusions and foils, whose supplies do not exceed 100,000 lb. The limitation on larger inventories of these forms and shapes of aluminum was changed from 60 days to 90 days.

To the extent that the inventory changes will induce customers to place additional orders on the fabricating mills in the third quarter, it will keep some of the plants with declining order loads in a better position to serve any increases in military orders that may come later in the year, the Aluminum Div. said, and will permit the labor force of the industry to be maintained to a greater extent.

•

Aluminum Castings Urged

Washington

• • • Pointing out that the shortage of grey iron castings will continue, WPB has recommended to manufacturers of fractional horsepower motors that they use aluminum as a substitute for motor end brackets. The industry was advised, in light of urgent need for this type of motors in both reconversion and military programs, to investigate other solutions to their problem. Several companies, WPB said, are working with aluminum, declaring that it offers good long range possibilities as well as immediate help.

Discussing the situation regarding grey iron castings, WPB said that requirements are going up, and the supply does not appear to be gaining because working conditions in the foundries impair production in the summer. This situation, it was asserted, will improve with cool weather but the shortage is expected to persist.

A list of aluminum foundries now having open capacities has been sent the motor manufacturers. It is not a complete list, WPB said, and other foundries will open as aircraft cuts continue and the situation on sand and permold aluminum castings becomes easier.

The list of aluminum companies sent motor manufacturers follows:

Aluminum Alloys Co., Detroit; Ebaloy Foundries, Rockford, Ill.; General Malleable Co., Waukesha, Wis.; Hampden Brass, Springfield, Mass.; John Harsch Corp., Cleveland; Metal & Alloy Specialties, Buffalo; Metal Parts Corp., Racine, Wis.; Oberdorfer Foundries, Syracuse, N. Y.; Peerless Foundry, Bridgeport, Conn.; Wolf & Dungey, Syracuse, N. Y.

•

Zinc Industry Gains Stocks

Washington

• • • During May the zinc industry showed a general overall gain in stocks, production, consumption and shipments, according to the Bureau of Mines. The exceptions were small decreases in receipts and inventories of slab zinc at consumers' plants.

Stocks of zinc oxide and zinc dust were higher than at the end of April, but consumers' stocks of slab zinc declined 5 pct, the first break in the upward trend since November, 1944.

Total production of zinc oxide, zinc dust and slab zinc rose moderately, but in the case of slab zinc the daily rate of output was less than in April.

Consumption of slab zinc increased slightly over April. All industry groups consumed more zinc except brass mills and brass ingot makers and foundries. In May galvanizers and brass mills were nearly equal in their use of this metal.

Receipts of slab zinc at consumers' plants again showed a decrease. For the first time since November, 1944, galvanizers accounted for the largest percentage of the total receipts.

Secondary slab zinc production at 8 operating plants in May (secondary smelters only) amounted to 2224 tons, including 819 tons of Intermediate, 204 tons of Brass Special, and 1201 tons of Prime Western. Production of Intermediate and Brass Special increased, but Prime Western grade decreased, the reversal of the trend shown in April.

The total zinc in transit at the end of May was 42 pct less than the amount in transit at the end of April. The tonnage routed to companies manufacturing brass products was 39 pct of the total compared with 49 pct at the end of April, 55 pct at the end of March, and 60 pct at the end of January and February.

Lead Scrap Consumption Up

Washington

• • • During May, remelters, smelters and refiners of lead-base scrap and residues broke all previous records made since the inception of the monthly surveys in the conversion of scrap to secondary metals, according to the Bureau of Mines.

The former high point in use of lead scrap was recorded in March of this year when 40,587 tons were consumed at smelters' plants, but the May figure of 43,328 tons was 2741 tons greater and exceeded the consumption figure for May 1944, by 9372 tons. Treatment of battery-lead plates in May advanced 5871 tons, common babbitt 556 tons, type metals 379 tons, and slag 1084 tons over the previous month, while use of solder and soft and hard lead declined. Total gain over the consumption for April amounted to 17 pct or 6480 tons.

•

Silicon Metal Price Ruling

Washington

• • • Sellers of silicon metal or ferrosilicon of grades different from those for which specific maximum prices are provided may after Aug. 1, 1945, submit proposed prices for the items to the Office of Price Administration for approval.

Pending approval of the price, the seller may sell and deliver the item subject to adjustment if the price submitted for approval is different from the one that is approved by OPA.

•

Speeds Use of Magnesium

Midland, Mich.

• • • Enlargement of prewar uses of magnesium and development of new application is being speeded by Dow Chemical Co., it was stated in the annual report published July 30, because some facilities are now becoming available for civilian work.

Of total magnesium division personnel at Dow, 4.5 pct are research workers today, compared with 15 pct ten years ago and 25 pct 20 yr ago, indicating that production has achieved a more normal balance with development.

Primary Metals

(Cents per lb., unless otherwise noted)

Aluminum, 99+%, del'd (Min. 10,000 lb.)	15.00
Antimony, American, Laredo, Tex.	14.50
Beryllium copper, 3.75-4.25% Be; dollars per lb. contained Be	$17.00
Cadmium, del'd	90.00
Cobalt, 97-99% (per lb.)	$1.50 to $1.57
Copper, electro, Conn. valley	12.00
Copper, electro, New York	11.75
Copper, lake	12.00
Gold, U. S. Treas., dollars per oz.	$35.00
Indium, 99.8%, dollars per troy oz.	$3.00
Iridium, dollars per troy oz.	$120.00
Lead, St. Louis	6.35
Lead, New York	6.50
Magnesium, 99.9 + %, carlots	20.50
Magnesium, 12-in. sticks, carlots	27.50
Mercury, dollars per 76-lb. flask, f.o.b. New York	$145.00 to $149.00
Nickel, electro	35.00
Palladium, dollars per troy oz.	$24.00
Platinum, dollars per oz.	$35.00
Silver, open market, New York, cents per oz.	44.75
Tin, Straits, New York	52.00
Zinc, East St. Louis	8.25
Zinc, New York	8.65

Remelted Metals

(Cents per lb. unless otherwise noted)

Aluminum, No. 12 Fdy. (No. 2)	9.00 to 10.00
Aluminum, deoxidizing No. 2, 3, 4	$6.00 to 9.50
Brass Ingot	
85-5-5-5 (No. 115)	13.25
88-10-2 (No. 215)	16.75
80-10-10 (No. 305)	16.00
No. 1 Yellow (No. 405)	10.25

Copper, Copper Base Alloys

(Mill base, cents per lb.)

	Extruded Shapes	Rods	Sheets
Copper	20.87	....	20.37
Copper, H.R.	....	17.37	....
Copper drawn	....	18.37	....
Low brass, 80%	....	20.40	20.15
High brass	....	....	19.48
Red brass, 85%	....	20.61	20.36
Naval brass	20.37	19.12	24.50
Brass, free cut	....	15.01	....
Commercial bronze, 90%	....	21.32	21.07
Commercial bronze, 95%	....	21.53	21.28
Manganese bronze	24.00	....	28.00
Phos. bronze, A, B, 5%	....	36.50	36.25
Muntz metal	20.12	18.37	22.75
Everdur, Herculoy, Olympic or equal	....	25.50	26.00
Nickel silver, 5%	....	28.75	26.50
Architect bronze	19.12	....	....

Aluminum

(Cents per lb., subject to extras on gage, size, temper, finish, factor number, etc.)

Tubing: 3 in. O.D. x 0.065 in. wall 2S, 40c. (½H); 52S, 61c. (O); 24S, 67½c. (T).

Plate: 0.250 in. and heavier: 2S and 3S, 21.2c.; 52S, 24.2c.; 61S, 22.8c.; 24S, 24.2c.

Flat Sheet: 0.188 in. thickness: 2S and 3S, 22.7c. a lb.; 52S, 26.2c.; 61S, 24.7c.; 24S, 26.7c.

2000-lb. base for tubing; 30,000-lb. base for plate, flat stock.

Extruded Shapes: "As extruded" temper; 2000-lb. base, 2S and 3S, factor No. 1 to 4, 25.5c.; 14S, factor No. 1 to 4, 35c.; 17S, factor No. 1 to 4, 31c.; 24S, factor No. 1 to 4, 34c.; 53S, factor No. 1 to 4, 23c.; 61S, factor No. 1 to 4, 28½c.

The factor is determined by dividing perimeter of shape by weight per lineal foot.

Wire Rod and Bar: Base price; 17ST and 11ST-3, screw machine stock. Rounds: ¼ in., 28½c. per lb.; ½ in., 26c.; 1 in., 24½c.; 2 in., 23c. Hexagonals: ¼ in., 34½c. per lb.; ½ in., 28½c.; 1 in., 25½c.; 2 in., 25½c. 2S, as fabricated, random or standard lengths, ½ in., 34c. per lb.; ½ in., 25c.; 1 in., 24c.; 2 in., 23c. 24ST, rectangles and squares, random or standard lengths. 0.093-0.187 in. thick by 1.001-2.000 in. wide, 33c. per lb.; 0.751-1.500 in. thick by 2.001-4.000 in. wide, 29c.; 1.501-2.000 in. thick by 4.001-6.000 in. wide, 27½c.

Magnesium

Sheet, rod, tubes, bars, extruded shapes subject to individual quotations. Metal turnings: 100 lb. or more, 46c. a lb.; 25 to 99 lb., 56c.; less than 25 lb., 66c.

NONFERROUS SCRAP METAL QUOTATIONS

†(OPA basic maximum prices, cents per lb., f.o.b. point of shipment, subject to quality, quantity and special preparation premiums—other prices are current quotations)

Copper, Copper Base Alloys

OPA Group 1†

No. 1 wire, No. 1 heavy copper	9.75
No. 1 tinned copper wire, No. 1 tinned heavy copper	9.75
No. 2 wire, mixed heavy copper	8.75
Copper tuyeres	8.75
Light copper	7.75
Copper borings	9.75
No. 2 copper borings	8.75
Lead covered copper wire, cable	6.00*
Lead covered telephone, power cable	6.04
Insulated copper	5.10*

OPA Group 2†

Bell metal	15.50
High grade bronze gears	13.25
High grade bronze solids	11.50*
Low lead bronze borings	11.50*
Babbitt lined brass bushings	13.00
High lead bronze solids	10.00*
High lead bronze borings	10.00*
Red trolley wheels	10.75
Tinny (phosphor bronze) borings	10.50
Tinny (phosphor bronze) solids	10.50
Copper-nickel solids and borings	9.25
Bronze paper mill wire cloth	9.50
Aluminum bronze solids	9.00
Soft red brass (No. 1 composition)	9.00
Soft red brass borings (No. 1)	9.00
Gilding metal turnings	8.50
Contaminated gilded metal solids	8.00
Unlined standard red car boxes	8.25
Lined standard red car boxes	7.75
Cocks and faucets	7.75
Mixed brass screens	7.75
Red brass breakage	7.50
Old nickel silver solids, borings	6.25
Copper lead solids, borings	6.25
Yellow brass castings	6.25
Automobile radiators	7.00
Zincy bronze borings	8.00
Zincy bronze solids	8.00

OPA Group 3†

Fired rifle shells	8.25
Brass pipe	7.50
Old rolled brass	7.00
Admiralty condenser tubes	7.50
Muntz metal condenser tubes	7.00
Plated brass sheet, pipe reflectors	6.50
Manganese bronze solids	7.25[1]
Manganese bronze solids	6.25[2]
Manganese bronze borings	6.50[1]

OPA Group 4†

Refinery brass	4.75*

*Price varies with analysis. [1] Lead content 0.00 to 0.40 per cent. [2] Lead content 0.41 to 1.00 per cent.

Other Copper Alloys

Briquetted Cartridge Brass Turnings	8.62½
Cartridge Brass Turnings, Loose	7.87½
Loose Yellow Brass Trimmings	7.87½

Aluminum

Plant scrap, segregated

2S solids	8.00
Dural alloys, solids 14, 17, 18, 24S	4.50
25S turnings, dry basis	3.00
Low copper alloys 51, 52, 61, 63S solids	7.50
turnings, dry basis	5.75

Plant scrap, mixed

Solids	4.00
Turnings, dry basis	2.75

Obsolete scrap

Pure cable	8.00
Old sheet and utensils	6.00
Old castings and forgings	5.00
Pistons, free of struts	5.00
Pistons, with struts	3.00
Old alloy sheet	5.00

Magnesium*

Segregated plant scrap

Pure solids and all other solids, exempt	
Borings and turnings	1.50

Mixed, contaminated plant scrap

Grade 1 solids	3.00
Grade 1 borings and turnings	2.00
Grade 2 solids	3.00
Grade 2 borings and turnings	1.00

*Nominal.

Zinc

New zinc clippings, trimmings	6.50
Engravers, lithographers plates	6.50
Old zinc scrap	4.75
Unsweated zinc dross	5.00
Die cast slab	4.50
New die cast scrap	4.48
Radiator grilles, old and new	3.50
Old die cast scrap	3.00

Lead

Deduct 0.55c. a lb. from refined metal basing point prices or soft and hard lead including cable, for f.o.b. point of shipment price.

Nickel

Ni content 98+%, Cu under ½%, 26c. per lb.; 90 to 98% Ni, 26c. per lb contained Ni.

ELECTROPLATING ANODES AND CHEMICALS

Anodes

(Cents per lb., f.o.b. shipping point in 500 lb lots)

Copper, frt. allowed	
Cast, oval, 15 in. or longer	25½
Electrodeposited	13⅞
Rolled, oval, straight	19½
Curved	20¾
Brass, 80-20, frt. allowed	
Cast, oval, 15 in. or longer	23½
Zinc, cast, 99.99, 15 in. or longer	16¼
Nickel, 99 per cent plus, frt. allowed	
Cast	47
Rolled, depolarized	43
Silver, 999 fine	
Rolled, 1-9 troy oz., per oz.	58*

Chemicals

(Cents per lb., f.o.b. shipping point)

Copper cyanide, 1-5 bbls.	34.00
Copper sulphate, 99.5, crystals, bbls.	7.75
Nickel salts, single, 425 lb. bbls., frt. allowed	13.50
Silver cyanide, 100 oz. lots	—.4175
Sodium cyanide, 96 per cent, domestic, 100 lb. drums	15.00
Zinc cyanide, 100 lb. drums	33.00
Zinc sulphate, 39 per cent, crystals, bbls., frt. allowed	6.35

*Price based on use of foreign silver.

SCRAP

. . . News and Market Activities

Turnings at Ceiling in Tight Market

New York

• • • Main feature of the market in all areas this week is the additional strength in the turnings. Practically every district has reported these items at ceiling. Furthermore it appears that consumers are not getting what they need or want.

Springboards are being used frequently and in many cases areas are drawing scrap from remote areas. As an example it is noted that the Youngstown district is actively seeking scrap from far points—that is much farther than has been the case for sometime.

While some observers believe that the present condition is an aftermath of a process of letting stocks get down low previous to the end of the war with Germany others profess to see the tight situation as the result of war cutbacks and a slow reconversion.

Many of the war plants furnished turnings and other grades in good volume. Now with output at those plants curtailed and with the chance that civilian manufacturers may not get into heavy volume production for sometime it is believed that a void may exist for awhile in an adequate supply of scrap. Practically all scrap grades are now at ceiling level.

•

PITTSBURGH — The scrap market here in all grades is very tight. Short shoveling turnings have advanced to full ceiling plus springboards varying from 50c. to $1.50. The bulk of the sales are at the 50c. springboard, however. No activity was discernible in the machine shop turnings market here, and the market remained at the $14.50 to $15.00 range. Heavy grades are extremely scarce, with a car of No. 1 heavy melting being almost a rarity. Billings of dealers and brokers have dropped off quite sharply in the past few weeks, with demands strong from the mills. On machine shop turnings, Johnstown is paying part springboard. One interesting note in the market this week was a reported shipment of about 1500 tons of short shoveling turnings from Denver, to the Valley, costing in the neighborhood of about $20.00 a ton. This is indicative of the shortage of scrap faced by Valley mills.

•

CHICAGO—Heavy purchases on short shoveling turnings and machine shop turnings respectively by two major Chicago district consumers last week confined those grades at ceilings. The short turning's order, for about 20,000 tons will cause new buying pressure in that category. Some brokers have been forced to pay ceiling prices for some time in order to fill old orders. Springboards on melting steel and bundled turnings now stand at $1.50 and $1.00 respectively with the latter figure now also reported on short turnings. Shipments to mills in this district during the past month have been the heaviest on record but brokers report difficulty in placing new orders. Allocations from remote areas are heavy.

•

PHILADELPHIA — Short shoveling turnings are now at ceiling, selling for $15.75 a gross ton. Other than this price increase, the scrap market this week is unchanged with mills still calling for better shipments than they have been getting.

•

DETROIT—All automotive lists brought ceiling prices at the end of July, and dealer stocks of turnings grades also were bringing top prices along with everything else. Total scrap shipments continue in low ground, one source estimating they were off at least a third from earlier levels. The short supply, coupled with undiminished demand, developed a general expectation that ceiling prices would be maintained for some time into the future.

•

BUFFALO—The market for steel making scrap was as hot as the weather this week as receipts continued below consumption. "Raiding" in central New York by Pittsburgh and Youngstown was reported a factor in reducing the already subnormal flow of scrap to this center. Although local prices were unchanged, Valley interests are said to be paying full springboards for turnings in that part of the Buffalo scrap basin. No additional orders of consequence have been placed by the local mills here, but the next week or two is expected to result in a thorough test of dealer's ideas of maximum prices for light material.

•

CLEVELAND—All prices are at ceiling here. The Valley springboard on short shoveling is $1.25. Machine shop turnings are carrying $1.25 springboard at Youngstown. Inventories at the mills are far from satisfactory. Prices were not keeping scrap back and higher prices haven't brought it out, although every pound that is around will move this week. Probably the only answer here is a lower operating rate which is not probable.

•

BOSTON—All materials are again at ceilings. Shoveling turnings, wheretofore in light request, are now wanted at $12.05 a ton on cars at Boston and at $11.06 outside Boston. In general, the market is less active than a fortnight ago due to a tightening in supplies and available cars. Bidding for Boston navy yard scrap was active with Bethlehem Steel competing with brokers and yards for items.

•

BIRMINGHAM—Activity in this market has taken a decided upward trend with increased demand for all grades. A stronger tone is attributed to such factors as the cutbacks at war plants which previously had been important scrap producers and to movement to Northern mills of both open hearth and foundry grades.

•

CINCINNATI—The market here has entered a tight situation, with the result that virtually all items are now quotable at the ceiling. Demand for scrap continues to be strong, and so far no dislocation as a result of inability to make shipments has been reported. Yard supplies are in fair volume, but dealers are still plagued by a lack of adequate labor.

•

ST. LOUIS—Hot weather in St. Louis producing area has had a bad effect on the movement of scrap iron to this industrial district but the shortage of labor is still the worst deterrent to heavier shipments. Workers affected by war plant cutbacks are seemingly uninterested in the lower pay in the scrap iron industry. Machine stop turnings are back at the ceiling price due mainly to outside buying.

•

Luria Bros. Opens New Toledo Yard

Cleveland

• • • Luria Brothers & Co., Inc., long prominent in the scrap iron and steel business, have announced the construction of a scrap iron and steel plant at Toledo, Ohio, with combination dock and rail facilities on the Maumee River. This will enable the company to operate in the local market on the same basis as a Cleveland dealer.

In making the announcement, Jack Levand, Luria's Ohio district manager, stated that the new facility will have storage capacity for 100,000 tons of scrap and will be for wholesale business only. Present plans include the installation of a drop for cast iron, cranes, shears, and supplementary equipment including a locomotive and a caterpillar.

According to Mr. Levand, it is anticipated that the new yard will handle incoming and outgoing cargoes of iron and steel scrap and shipments by rail as well. The yard, at which boat scrap will be prepared, will have more than one-half mile of railroad tracks and will be in operation by about Sept. 1.

Going prices as obtained in the trade by IRON AGE editors, based on representative tonnages (for ceiling prices see O. P. A. schedule No. 4). Where ceiling prices are quoted they do not include brokerage fee or adjusted transportation charges. Asterisks indicate grades selling at ceilings.

PITTSBURGH

Per gross ton delivered to consumer:

No. 1 hvy. melting	$20.00*
RR. hvy. melting	21.00*
No. 2 hvy. melting	20.00*
RR. scrap rails	21.50*
Rails 3 ft. and under	23.50*
No. 1 comp'd sheets	20.00*
Hand bdld. new shts.	20.00*
Hvy. axle turn.	19.50*
Hvy. steel forge turn.	19.50*
Mach. shop turn.	$14.50 to 15.00
Short shov. turn.	17.00*
Mixed bor. and turn.	14.50 to 15.00
Cast iron borings	16.00*
Hvy. break cast.	16.00*
No. 1 cupola	20.00*
RR. knuck. and coup.	24.50*
RR. coil springs	24.50*
Rail leaf springs	24.50*
Rolled steel wheels	24.50*
Low phos. bil. crops	25.00*
Low phos.	22.50*
RR. malleable	22.00*

CHICAGO

Per gross ton delivered to consumer:

No. 1 hvy. melting	$18.75*
No. 2 hvy. melting	18.75*
No. 1 bundles	18.75*
No. 2 dealers' bndls.	18.75*
Bundled mach. shop turn.	18.75*
Galv. bundles	16.75*
Mach. shop turn.	13.75*
Short shovel, turn.	15.75*
Cast iron borings	14.75*
Mix. borings & turn.	13.75*
Low phos. hvy. forge	23.75*
Low phos. plates	21.25*
No. 1 RR. hvy. melt.	19.75*
Reroll rails	22.25*
Miscellaneous rails	20.25*
Rails 3 ft. and under	22.25*
Locomotive tires, cut	22.75 to 23.25
Cut bolsters & side frames	20.25 to 21.25
Angles & splice bars	22.25*
Standard stl. car axles	25.00 to 25.50
No. 3 steel wheels	23.25*
Couplers & knuckles	23.25*
Agricul. malleable	22.00*
RR. malleable	22.00*
No. 1 mach. cast	20.00*
No. 1 agricul. cast	20.00*
Hvy. breakable cast.	16.50*
RR. grate bars	15.25*
Cast iron brake shoes	15.25*
Stove plate	19.00*
Clean auto cast.	20.00*
Cast iron carwheels	20.00*

CINCINNATI

Per gross ton delivered to consumer:

No. 1 hvy. melting	$19.50*
No. 2 hvy. melting	19.50*
No. 1 bundles	19.50*
No. 2 bundles	19.50*
Mach. shop turn.	$8.50 to 9.00
Shoveling turn.	10.50 to 11.00
Cast iron borings	9.00 to 9.50
Mixed bor. & turn.	8.50 to 9.00
Low phos. plate	22.00*
No. 1 cupola cast.	20.00*
Hvy. breakable cast.	16.50*
Stove plate	19.00*
Scrap rails	21.00

BOSTON

Dealers' buying prices per gross ton, f.o.b. cars

No. 1 hvy. melting	$15.05*
No. 2 hvy. melting	15.05*
No. 1 and 2 bundles	15.05*
Busheling	15.05*
Turnings, shovelings	12.05*
Machine shop turn.	10.05*
Mixed bor. & turn.	10.05*
Cl'n cast, chem. bor.	13.06 to 14.15*
Truck delivery to foundry	
Machinery cast.	21.00 to 23.51*
Breakable cast	21.57 to 21.87*
Stove plate	20.00 to 23.51*

DETROIT

Per gross ton, brokers' buying prices:

No. 1 hvy. melting	$17.32*
No. 2 hvy. melting	17.32*
No. 1 bundles	17.32*
New busheling	17.32*
Flashings	17.32*
Mach. shop turn.	12.32*
Short shov. turn.	14.32*
Cast iron borings	13.32*
Mixed bor. & turn.	12.32*
Low phos. plate	19.82*
No. 1 cupola cast.	20.00*
Charging box cast.	19.00*
Hvy. breakable cast.	16.50*
Stove plate	19.00*
Automotive cast	20.00*

PHILADELPHIA

Per gross ton delivered to consumer:

No. 1 hvy. melting	$18.75*
No. 2 hvy. melting	18.75*
No. 2 bundles	18.75*
Mach. shop turn.	13.75*
Shoveling turn.	15.75*
Cast iron borings	13.50 to 14.00
Mixed bor. & turn.	13.75*
No. 1 cupola cast	20.00*
Hvy. breakable cast	16.50*
Cast, charging box	19.00*
Hvy. axle, forge turn.	18.75*
Low phos. plate	21.25*
Low phos. punchings	21.25*
Billet crops	21.25*
RR. steel wheels	23.25*
RR. coil springs	23.25*
RR. malleable	22.00*

ST. LOUIS

Per gross ton delivered to consumer:

Heavy melting	$17.50*
Bundled sheets	17.50*
Mach. shop turn.	12.75*
Locomotive tires, uncut.	18.00
Misc. std. sec. rails	19.00*
Rerolling rails	21.00*
Steel angle bars	21.00*
Rails 3 ft. and under	21.50*
RR. springs	22.00*
Steel car axles	23.50*
Stove plate	19.00*
Grate bars	15.25*
Brake shoes	15.25*
RR. malleable	22.00*
Cast iron carwheels	20.00*
No. 1 mach'ery cast	20.00*
Breakable cast	16.50*

BIRMINGHAM

Per gross ton delivered to consumer:

No. 1 hvy. melting	$17.00*
No. 2 hvy. melting	17.00*
No. 2 bundles	17.00*
No. 1 busheling	17.00*
Long turnings	$9.50 to 10.00
Cast iron borings	10.50 to 11.00
Bar crops and plate	19.50*
Structural and plate	19.50*
No. 1 cast	20.00*
Stove plate	17.00
Steel axles	18.00*
Scrap rails	18.50
Rerolling rails	20.50*
Angles & splice bars	20.50*
Rails 3 ft. & under	21.00*
Cast iron carwheels	16.50 to 17.00

YOUNGSTOWN

Per gross ton delivered to consumer:

No. 1 hvy. melting	$20.00*
No. 2 hvy. melting	20.00*
Low phos. plate	22.50*
No. 1 busheling	20.00*
Hydraulic bundles	20.00*
Mach. shop. turn.	15.00*
Short shovel. turn.	17.00*
Cast iron borings	16.00*

NEW YORK

Brokers' buying prices per gross ton, on cars:

No. 1 hvy. melting	$15.33*
No. 2 hvy. melting	15.33*
Comp. black bundles	15.33*
Comp. galv. bundles	13.33*
Mach. shop turn.	10.33*
Mixed bor. & turn.	10.33*
Shoveling turn.	12.33*
No. 1 cupola cast	20.00*
Hvy. breakable cast	16.50*
Charging box cast	19.00*
Stove plate	19.00*
Clean auto cast.	20.00*
Unstrip. motor blks.	17.50*
Cl'n chem. cast bor.	14.33*

BUFFALO

Per gross ton delivered to consumer:

No. 1 hvy. melting	$19.25*
No. 1 bundles	19.25*
No. 2 bundles	19.25*
No. 2 hvy. melting	19.25*
Mach. shop turn.	13.00
Shoveling turn.	16.00
Cast iron borings	14.00
Mixed bor. & turn.	13.00
No. 1 cupola cast	20.00*
Stove plate	19.00*
Low phos. plate	21.75*
Scrap rails	20.75*
Rails 3 ft. & under	22.75*
RR. steel wheels	23.75*
Cast iron car wheels	20.00*
RR. coil & leaf spgs.	23.75*
RR. knuckles & coup.	23.75*
RR. malleable	22.00*
No. 1 busheling	19.25*

CLEVELAND

Per gross ton delivered to consumer:

No. 1 hvy. melting	$19.50*
No. 2 hvy. melting	19.50*
Compressed sheet stl.	19.50*
Drop forge flashings	19.00*
No. 2 bundles	19.50*
Mach. shop turn.	14.50*
Short shovel.	16.50*
No. 1 busheling	19.50*
Steel axle turn.	19.00*
Low phos. billet and bloom crops	24.50*
Cast iron borings	15.50*
Mixed bor. & turn.	14.50*
No. 2 busheling	17.00*
No. 1 machine cast	20.00*
Railroad cast	20.00*
Railroad grate bars	15.25*
Stove plate	19.00*
RR. hvy. melting	20.50*
Rails 3 ft. & under	23.00*
Rails 18 in. & under	24.25*
Rails for rerolling	23.00*
Railroad malleable	22.00*
Elec. furnace punch	22.00*

SAN FRANCISCO

Per gross ton delivered to consumer:

RR. hvy. melting	$16.50
No. 1 hvy. melting	16.50
No. 2 hvy. melting	15.00
No. 2 bales	$13.50 to 14.25
No. 3 bales	9.50 to 10.59
Mach. shop turn.	7.00
Elec. furn. 1 ft., und.	15.50 to 17.00
No. 1 cupola cast.	19.00 to 21.00

LOS ANGELES

Per gross ton delivered to consumer:

No. 1 hvy. melting	$14.50 to $15.50
No. 2 hvy. melting	13.50 to 14.50
No. 2 bales	12.50 to 13.50
No. 3 bales	9.00 to 10.00
Mach. shop turn.	4.50
No. 1 cupola cast.	19.00 to 21.00

SEATTLE

Per gross ton delivered to consumer:

RR. hvy. melting	$14.50
No. 1 hvy. melting	14.50*
No. 3 bundles	11.50
Elec. furn. 1 ft., und.	17.00
No. 1 cupola cast	20.00*

Comparison of Prices . .

Advances Over Past Week in Heavy Type; Declines in *Italics*. Prices are F.O.B. Major Basing Points. The various basing points for finished and semi-finished steel are listed in the detailed price tables, pages 140-148.

Flat Rolled Steel (Cents Per Lb.)	July 31, 1945	July 24, 1945	June 26, 1945	Aug. 1, 1944
Hot rolled sheets	2.20	2.20	2.20	2.10
Cold rolled sheets	3.05	3.05	3.05	3.05
Galvanized sheets (24 ga.)	3.70	3.70	3.70	3.50
Hot rolled strip	2.10	2.10	2.10	2.10
Cold rolled strip	2.80	2.80	2.80	2.80
Plates	2.25	2.25	2.25	2.10
Plates, wrought iron	3.80	3.80	3.80	3.80
Stain's c.r. strip (No. 302)	28.00	28.00	28.00	28.00
Tin and Terne Plate: (Dollars Per Base Box)				
Tin plate, standard cokes	$5.00	$5.00	$5.00	$5.00
Tin plate, electrolytic	4.50	4.50	4.50	4.50
Special coated mfg. ternes	4.30	4.30	4.30	4.30
Bars and Shapes: (Cents Per Lb.)				
Merchant bars	2.25	2.25	2.25	2.15
Cold finished bars	2.65	2.65	2.65	2.65
Alloy bars	2.70	2.70	2.70	2.70
Structural shapes	2.10	2.10	2.10	2.10
Stainless bars (No. 302)	24.00	24.00	24.00	24.00
Wrought iron bars	4.40	4.40	4.40	4.40
Wire and Wire Products: (Cents Per Lb.)				
Bright wire	2.75	2.75	2.75	2.60
Wire nails	2.90	2.90	2.90	2.55
Rails: (Dollars Per Gross Ton)				
Heavy rails	$43.00	$43.00	$43.00	$40.00
Light rails	45.00	45.00	45.00	40.00
Semi-Finished Steel: (Dollars Per Gross Ton)				
Rerolling billets	$36.00	$36.00	$36.00	$34.00
Sheet bars	36.00	36.00	36.00	34.00
Slabs, rerolling	36.00	36.00	36.00	34.00
Forging billets	42.00	42.00	42.00	40.00
Alloy blooms, billets, slabs	54.00	54.00	54.00	54.00
Wire Rods and Skelp: (Cents Per Lb.)				
Wire rods	2.15	2.15	2.15	2.00
Skelp	1.90	1.90	1.90	1.90

Latest steel price increase, Amendment 13 to RPS6, effective May 23, 1945.

Pig Iron: (Per Gross Ton)	July 31, 1945	July 24, 1945	June 26, 1945	Aug. 1, 1944
No. 2 fdy., Philadelphia	$26.84	$26.84	$26.84	$25.84
No. 2, Valley furnace	25.00	25.00	25.00	24.00
No. 2, Southern, Cin'ti	26.11	26.11	26.11	25.11
No. 2, Birmingham	21.38	21.38	21.38	20.38
No. 2, foundry, Chicago†	25.00	25.00	25.00	24.00
Basic, del'd eastern Pa.	26.34	26.34	26.34	25.34
Basic, Valley furnace	24.50	24.50	24.50	23.50
Malleable, Chicago†	25.00	25.00	25.00	24.00
Malleable, Valley	25.00	25.00	25.00	24.00
L. S. charcoal, Chicago*	42.34	42.34	42.34	37.34
Ferromanganese‡	135.00	135.00	135.00	135.00

† The switching charge for delivery to foundries in the Chicago district is 60c. per ton.

‡ For carlots at seaboard.

Last pig iron price change authorized by OPA effective Feb. 14, 1945.

* Charcoal price increase retroactive to March 7, on contracts to Feb. 13.

Scrap: (Per Gross Ton)				
Heavy melt'g steel, P'gh.	$20.00	$20.00	$20.00	$20.00
Heavy melt'g steel, Phila.	18.75	18.75	18.75	18.75
Heavy melt'g steel, Ch'go	18.75	18.75	18.75	18.75
No. 1 hy. comp. sheet, Det.	17.32	17.32	17.32	17.85
Low phos. plate, Youngs'n	22.50	22.50	22.50	22.50
No. 1 cast, Pittsburgh	20.00	20.00	20.00	20.00
No. 1 cast, Philadelphia	20.00	20.00	20.00	20.00
No. 1 cast, Chicago	20.00	20.00	20.00	20.00
Coke, Connellsville: (Per Net Ton at Oven)				
Furnace coke, prompt	$7.50	$7.50	$7.50	$7.00
Foundry coke, prompt	9.00	9.00	9.00	8.25
Non-Ferrous Metals: (Cents Per Lb. to Large Buyers)				
Copper, electro., Conn.	12.00	12.00	12.00	12.00
Copper, Lake	12.00	12.00	12.00	12.00
Tin (Straits), New York	52.00	52.00	52.00	52.00
Zinc, East St. Louis	8.25	8.25	8.25	8.25
Lead, St. Louis	6.35	6.35	6.35	6.35
Aluminum, Virgin, del'd.	15.00	15.00	15.00	15.00
Nickel, electrolytic	35.00	35.00	35.00	35.00
Magnesium, ingot	20.50	20.50	20.50	20.50
Antimony, Laredo, Tex.	14.50	14.50	14.50	14.50

Composite Prices . .

Starting with the issue of April 22, 1943, the weighted finished steel price index was revised for the years 1941, 1942 and 1943. See explanation of the change on page 90 of the April 22, 1943, issue. Index revised to a quarterly basis as of Nov. 16, 1944; for details see p. 98 of that issue. The finished steel composite prices for the current quarter are an estimate based on finished steel shipments for the previous quarter. These figures will be revised when the actual data of shipments for this quarter are compiled.

	FINISHED STEEL	PIG IRON	SCRAP STEEL
July 31, 1945	2.41571c. a Lb.	$24.61 a Gross Ton	$19.17 a Gross Ton
One week ago	2.41571c. a Lb.	$24.61 a Gross Ton	$19.17 a Gross Ton
One month ago	2.41571c. a Lb.	$24.61 a Gross Ton	$19.17 a Gross Ton
One year ago	2.30837c. a Lb.	$23.61 a Gross Ton	$19.17 a Gross Ton

	FINISHED STEEL HIGH	FINISHED STEEL LOW	PIG IRON HIGH	PIG IRON LOW	SCRAP STEEL HIGH	SCRAP STEEL LOW
1945	2.41571c., May 29	2.21189c., Jan. 2	$24.61, Feb. 20	$23.61, Jan. 2	$19.17	$19.17
1944	2.30837c., Sept. 5	2.21189c., Oct. 5	$23.61	$23.61	19.17	$15.67, Oct. 24
1943	2.25513c.	2.25513c.	23.61	23.61	19.17	19.17
1942	2.26190c.	2.26190c.	23.61	23.61	19.17	19.17
1941	2.43078c.	2.43078c.	$23.61, Mar. 20	$23.45, Jan. 2	$22.00, Jan. 7	$19.17, Apr. 10
1940	2.30467c., Jan. 2	2.24107c., Apr. 16	23.45, Dec. 23	22.61, Jan. 2	21.83, Dec. 30	16.04, Apr. 9
1939	2.35367c., Jan. 3	2.26689c., May 16	22.61, Sept. 19	20.61, Sept. 12	22.50, Oct. 3	14.08, May 16
1938	2.58414c., Jan. 4	2.27207c., Oct. 18	23.25, June 21	19.61, July 6	15.00, Nov. 22	11.00, June 7
1937	2.58414c., Mar. 9	2.32263c., Jan. 4	23.25, Mar. 9	20.25, Feb. 16	21.92, Mar. 30	12.67, June 8
1936	2.32263c., Dec. 28	2.05200c., Mar. 10	19.74, Nov. 24	18.73, Aug. 11	17.75, Dec. 21	12.67, June 9
1935	2.07642c., Oct. 1	2.06492c., Jan. 8	18.84, Nov. 5	17.83, May 14	13.42, Dec. 10	10.33, Apr. 29
1934	2.15367c., Apr. 24	1.95757c., Jan. 2	17.90, May 1	16.90, Jan. 27	13.00, Mar. 13	9.50, Sept. 25
1933	1.95578c., Oct. 3	1.75836c., May 2	16.90, Dec. 5	13.56, Jan. 3	12.25, Aug. 8	6.75, Jan. 3
1932	1.89196c., July 5	1.83901c. Mar. 1	14.81, Jan. 5	13.56, Dec. 6	8.50, Jan. 12	6.43, July 5
1931	1.99626c., Jan. 13	1.86586c., Dec. 29	15.90, Jan. 6	14.79, Dec. 15	11.33, Jan. 6	8.50, Dec. 29
1930	2.25488c., Jan. 7	1.97319c., Dec. 9	18.21, Jan. 7	15.90, Dec. 16	15.00, Feb. 18	11.25, Dec. 9
1929	2.31773c., May 28	2.26498c., Oct. 29	18.71, May 14	18.21, Dec. 17	17.58, Jan. 29	14.08, Dec. 3

Weighted index based on steel bars, shapes, plates, wire, rails, black pipe, hot and cold-rolled sheets and strip, representing 78 per cent of the United States output. Index recapitulated in Aug. 28, 1941, issue.

Based on averages for basic iron at Valley furnaces and foundry iron at Chicago, Philadelphia, Buffalo, Valley and Southern iron at Cincinnati.

Based on No. 1 heavy melting steel scrap quotations to consumers at Pittsburgh, Philadelphia and Chicago.

CONTINENTAL WIRE MADE TO SPECIAL SHAPE CUTS COSTS ★ IMPROVES PRODUCTS

The use of wire drawn to special shapes is not a new practice . . . but it is a fast growing one. More and more manufacturers are learning how Continental wire made to fit the particular application can cut product costs and improve quality.

If you are a manufacturer, it may pay you to check over your product. Look for parts made of wire that can be "shape engineered" to do their job better and more economically. Continental shaped wire is used in many different products. It is available in a wide range of tempers, finishes and coatings; in sizes up to one-half inch diameter. Write today for a copy of Continental's handy new booklet with information for manufacturers.

CONTINENTAL STEEL CORPORATION

GENERAL OFFICES • KOKOMO, INDIANA

PRODUCERS OF *Manufacturer's Wire* in many sizes, shapes, tempers and finishes, including Galvanized, KOKOTE, Flame-Sealed, Coppered, Tinned, Annealed, Liquor Finished, Bright, Lead Coated, and special wire. ALSO, Coated and Uncoated Steel Sheets, Nails, Continental Chain Link Fence, and other products.

Prices of Finished Iron and Steel . . .

Steel prices shown here are f.o.b. basing points, in cents per lb. unless otherwise indicated. Extras apply. Delivered prices do not reflect 3% tax on freight. (1) Mill run sheet, 10c. per 100 lb. under base; primes, 25c. above base. (2) Unassorted commercial coating. (3) Widths up to 12-in. inclusive. (4) 0.25 carbon and less. (5) Applies to certain width and length limitations. (6) For merchant trade. (7) For straight length material only from producer to consumer. Discount of 25c. per 100 lb. to fabricators. (8) Also shafting. For quantities of 20,000 to 39,999 lb. (9) Carload lot in manufacturing trade. (10) Prices do not apply if rail and water is not used. (11) Boxed. (12) This base price for annealed, bright finish wires, commercial spring wire. (13) Produced to dimensional tolerances in AISI Manual Sect. 6. For price exceptions to finished and semi-finished steels turn several pages.

Basing Point / Product	Pittsburgh	Chicago	Gary	Cleveland	Birmingham	Buffalo	Youngstown	Sparrows Point	Granite City	Middletown, Ohio	Gulf Ports, Cars	Pacific Ports, Cars [10]	DELIVERED TO Detroit	New York	Philadelphia
SHEETS															
Hot rolled	2.20¢	2.20¢	2.20¢	2.20¢	2.20¢	2.20¢	2.20¢	2.20¢	2.30¢	2.20¢		2.75¢	2.30¢	2.44¢	2.37¢
Cold rolled [1]	3.05¢	3.05¢	3.05¢	3.05¢		3.05¢	3.05¢		3.15¢	3.05¢		3.70¢	3.15¢	3.39¢	3.37¢
Galvanized (24 gage)	3.70¢	3.70¢	3.70¢		3.70¢	3.70¢	3.70¢	3.70¢	3.80¢	3.70¢		4.25¢		3.94¢	3.87¢
Enameling (20 gage)	3.45¢	3.45¢	3.45¢	3.45¢			3.45¢		3.55¢	3.45¢		4.10¢	3.55¢	3.31¢	3.77¢
Long ternes [3]	3.80¢	3.80¢	3.80¢									4.55¢		4.16¢	4.12¢
STRIP															
Hot rolled [3]	2.10¢	2.10¢	2.10¢	2.10¢	2.10¢		2.10¢			2.10¢		2.75¢	2.20¢	2.46¢	
Cold rolled [4]	2.80¢	2.90¢		2.80¢			2.80¢	(Worcester=3.00¢)					2.90¢	3.16¢	
Cooperage stock	2.20¢	2.20¢			2.20¢		2.20¢							2.56¢	
Commodity C-R	2.95¢	3.05¢		2.95¢			2.95¢	(Worcester=3.35¢)					3.05¢	3.31¢	
TIN PLATE															
Standard cokes, base box	$5.00	$5.00	$5.00						$5.10					5.36¢	5.32¢
Electro, box 0.25 lb.	$4.35	$4.35	$4.35						$4.60						
Electro, box 0.50 lb.	$4.50	$4.50	$4.50						$4.75						
Electro, box 0.75 lb.	$4.65		$4.65												
BLACK PLATE															
29 gage [5]	3.05¢	3.05¢	3.05¢						3.15¢			4.05¢[11]			3.37¢
TERNES, MFG.															
Special coated, base box	$4.30	$4.30	$4.30						$4.40						
BARS															
Carbon steel	2.25¢	2.25¢	2.25¢	2.25¢	2.25¢	2.25¢		(Duluth=2.35¢)			2.60¢	2.90¢	2.35¢	2.59¢	2.57¢
Rail steel [6]	2.25¢	2.25¢	2.25¢	2.25¢	2.25¢	2.25¢					2.60¢	2.90¢			
Reinforcing (billet) [7]	2.15¢	2.15¢	2.15¢	2.15¢	2.15¢	2.15¢	2.15¢	2.15¢			2.50¢	2.55¢	2.25¢	2.39¢	
Reinforcing (rail) [7]	2.15¢	2.15¢	2.15¢	2.15¢	2.15¢	2.15¢	2.15¢				2.50¢	2.55¢	2.25¢		2.47¢
Cold finished [8]	2.65¢	2.65¢	2.65¢	2.65¢		2.65¢		(Detroit=2.70¢)			(Toledo=2.80¢)			2.99¢	2.97¢
Alloy, hot rolled	2.70¢	2.70¢				2.70¢		(Bethlehem, Massillon, Canton=2.70¢)					2.80¢		
Alloy, cold drawn	3.35¢	3.35¢	3.35¢	3.35¢		3.35¢							3.45¢		
PLATES								(Coatesville and Claymont=2.25¢)							
Carbon steel [13]	2.25¢	2.25¢	2.25¢	2.25¢	2.25¢		2.25¢	2.25¢			2.60¢	2.80¢	2.47¢	2.44¢	2.30¢
Floor plates	3.50¢	3.50¢									3.85¢	4.15¢		3.86¢	3.23¢
Alloy	3.50¢	3.50¢			(Coatesville=3.50¢)						3.95¢	4.15¢		3.70¢	3.59¢
SHAPES															
Structural	2.10¢	2.10¢	2.10¢		2.10¢	2.10¢		(Bethlehem=2.10¢)			2.45¢	2.75¢		2.27¢	2.215¢
SPRING STEEL, C-R															
0.26 to 0.50 Carbon	2.80¢			2.80¢			(Worcester=3.00¢)								
0.51 to 0.75 Carbon	4.30¢			4.30¢			(Worcester=4.50¢)								
0.76 to 1.00 Carbon	6.15¢			6.15¢			(Worcester=6.25¢)								
1.01 to 1.25 Carbon	8.35¢			8.35¢			(Worcester=8.55¢)								
WIRE [9]															
Bright [12]	2.75¢	2.75¢		2.75¢	2.75¢		(Worcester=2.85¢)			(Duluth=2.80¢)		3.25¢			3.07¢
Galvanized	Add proper size extra and galvanizing extra to Bright Wire base														
Spring (High Carbon)	3.35¢	3.35¢		3.35¢			(Worcester=3.45¢)					3.85¢			3.67¢
PILING															
Steel Sheet	2.40¢	2.40¢				2.40¢						2.95¢			2.73¢

SEMI-FINISHED STEEL

Ingots, Carbon, Rerolling

Base per gross ton, f.o.b. mill.... $31.00

Ingots, Carbon, Forging

Base per gross ton, f.o.b. Birmingham, Buffalo, Chicago, Cleveland, Gary, Pittsburgh, Youngstown $36.00

Ingots, Alloy

Base per gross ton, f.o.b. Bethlehem, Buffalo, Canton, Coatesville, Chicago, Massillon, Pittsburgh $45.00

Billets, Blooms and Slabs

Pittsburgh, Chicago, Gary, Cleveland, Youngstown, Buffalo, Birmingham, Sparrows Point (rerolling only). Prices delivered Detroit are $2.00 higher; delivered E. Michigan, $3 higher; f.o.b. Duluth, billets only, $2.00 higher; billets f.o.b. Pacific ports are $12 higher. Provo, $11.20 higher. Delivered prices do not reflect three per cent tax on freight rates.

	Per Gross Ton
Rerolling	$36.00
Forging quality	42.00

Alloy Billets, Blooms, Slabs

Pittsburgh, Chicago, Canton, Massillon, Buffalo or Bethlehem, per gross ton $54.00

Price delivered Detroit $2.00 higher; East Michigan, $3.00 higher.

Sheet Bars

Pittsburgh, Chicago, Cleveland, Youngstown, Buffalo, Canton, Sparrows Point.

	Per Gross Ton
Open hearth or bessemer	$36.00

PRICES

Skelp

Pittsburgh, Chicago, Youngstown, Coatesville, Pa., Sparrows Point, Md.

	Per Lb.
Grooved, universal and sheared	1.90c.

Wire Rods

(No. 5 to 9/32 in.)

	Per Lb.
Pittsburgh, Chicago, Cleveland	2.15c.
Worcester, Mass.	2.25c.
Birmingham	2.15c.
San Francisco	2.65c.
Galveston	2.40c.

9/32 in. to 47/64 in., 0.15c. a lb. higher. Quantity extras apply.

Shell Steel

	Per Gross Ton
3 in. to 12 in.	$52.00
12 in. to 18 in.	54.00
18 in. and over	56.00

Basic open hearth shell steel, f.o.b. Pittsburgh, Chicago, Buffalo, Gary, Cleveland, Youngstown and Birmingham.

Prices delivered Detroit are $2.00 higher; East Michigan, $3 higher.

Price Exceptions: Follansbee Steel Corp. permitted to sell at $13.00 per gross ton, f.o.b. Toronto, Ohio, above base price of $52.00.

Note: The above base prices apply on lots of 1000 tons of a size and section to which are to be added extras for chemical requirements, cutting, or quantity.

RAILS, TRACK SUPPLIES

(F.o.b. Mill)

Standard rails, heavier than 60 lb., No. 1 O.H., gross ton	$43.00
Angle splice bars, 100 lb.	2.70
(F.o.b. Basing Points)	*Per Gross Ton*
Light rails (from billets)	$45.00
Light rails (from rail steel)	44.00
	Base per Lb.
Cut spikes	3.25c.
Screw spikes	5.40c.
Tie plate, steel	2.30c.
Tie plates, Pacific Coast	3.45c.
Track bolts	4.75c.
Track bolts, heat treated, to railroads	5.00c.
Track bolts, jobbers discount	63-5

Basing points, light rails, Pittsburgh, Chicago, Birmingham; cut spikes and tie plates—Pittsburgh, Chicago, Portsmouth, Ohio, Weirton, W. Va., St. Louis, Kansas City, Minnequa, Colo., Birmingham and Pacific Coast ports; tie plates alone—Steelton, Pa., Buffalo. Cut spikes alone—Youngstown, Lebanon, Pa., Richmond, Oregon and Washington ports, add 25c.

TOOL STEEL

(F.o.b. Pittsburgh, Bethlehem, Syracuse)

	Base per lb.
High speed	67c.
Straight molybdenum	54c.
Tungsten-molybdenum	57½c.
High-carbon-chromium	43c.
Oil hardening	24c.
Special carbon	22c.
Extra carbon	18c.
Regular carbon	14c.

Warehouse prices east of Mississippi are 2c. a lb. higher; west of Mississippi 3c. higher.

WIRE PRODUCTS

To the trade, f.o.b. Pittsburgh, Chicago, Cleveland, Birmingham, Duluth

	Basing Points Named	*Pacific Coast Basing Points†*
	Base per Keg	
Standard wire nails	$2.90	$3.40
Coated nails	2.90	3.40
Cut nails, carloads	3.85	....
	Base per 100 Lb.	
Annealed fence wire	$3.05	$3.55
Annealed galv. fence wire	3.40	3.90
	Base Column	
Woven wire fence*	67	85
Fence posts, carloads	69	86
Single loop bale ties	66	91
Galvanized barbed wire**	72	82
Twisted barbless wire	72	....

*15½ gage and heavier. **On 80-rod spools in carload quantities.

†Prices subject to switching or transportation charges.

Do you want to —
- SPEED PRODUCTION
- ELIMINATE COOLANT PROBLEMS
- SAVE MONEY?

You can do all 3 with
RUTHMAN GUSHER COOLANT PUMPS

Reports from machine tool operators all over the country testify to the long life, low maintenance cost and steady dependable service of the Ruthman Gusher Coolant Pump. If you are interested in speeding production, eliminating coolant problems and saving money, specify Ruthman Gusher Coolant Pumps on your machines.

There's a Gusher for Every Coolant Requirement

WRITE NOW FOR CATALOG

MODEL 11020-A

THE RUTHMAN MACHINERY CO.
1821 READING ROAD CINCINNATI 2, OHIO
THE "GUSHER"
A MODERN PUMP FOR MODERN MACHINE TOOLS

WAREHOUSE PRICES

Delivered metropolitan areas per 100 lb. These are zoned warehouse prices in conformance with latest zoning amendment to OPA Price Schedule 49.

Cities	SHEETS			STRIP		Plates ¼ in. and heavier	Structural Shapes	BARS		ALLOY BARS			
	Hot Rolled (10 gage)	Cold Rolled	Galvanized (24 gage)	Hot Rolled	Cold Rolled			Hot Rolled	Cold Finished	Hot Rolled, NE 8617-20	Hot Rolled, NE 9442-45 Ann.	Cold Drawn, NE 8917-20	Cold Drawn, NE 9442-45 Ann.
**Philadelphia	$3.518	$4.872[2]	$4.768[a]	$3.922	$4.772	$3.605	$3.666	$3.822	$4.072	$5.818	$6.868	$7.072	$8.172
New York	3.59	4.613[3]	5.110	3.974[6]	4.772	3.768	3.758	3.853	4.103	5.858	6.908	7.103	8.203
Boston	3.744	4.744[9]	5.224[9]	4.106	4.715	3.912	3.912	4.044	4.144	6.012	7.062	7.194	8.394
Baltimore	3.394	4.852	4.894	3.902	4.752	3.594	3.759	3.802	4.052	....	....	....	....
Norfolk	3.771	4.965	5.371	4.165	4.865	3.971	4.002	4.065	4.165	....	....	....	....
Chicago	3.25	4.20	5.231	3.60	4.65[17]	3.55	3.55	3.50	3.75	5.60	6.65	6.65	7.90
Milwaukee	3.387	4.337[3]	5.272[4]	3.737	4.787[17]	3.687	3.687	3.637	3.887	5.837	6.887	6.887	7.987
Cleveland	3.35	4.40	4.877[4]	3.60	4.45	3.40	3.588	3.35	3.75	5.806	6.856	6.65	7.75
Buffalo	3.35	4.40	4.754	3.819	4.669	3.63	3.40	3.35	3.75	5.80	6.65	6.65	7.75
Detroit	3.45	4.50	5.004	3.70	4.859[17]	3.609	3.661	3.45	3.80	5.93	6.98	6.959	8.059
Cincinnati	3.425	4.475[3]	4.825[5]	3.675	4.711	3.661	3.691	3.611	4.011	5.95	7.00	7.011	8.261
St. Louis	3.397	4.347[3]	5.172[4]	3.747	4.931[17]	3.697	3.697	3.647	4.031	5.981	7.031	7.031	8.131
Pittsburgh	3.35	4.40	4.75	3.60	4.45	3.40	3.40	3.35	3.75	5.60	6.65	6.65	7.90
St. Paul	3.50	4.46	5.257[4]	3.86	5.102[17]	3.813[3]	3.813[3]	3.763[3]	4.361	5.94	5.99	7.361	8.461
Omaha	3.865	5.443	5.608[4]	4.215	..	4.165	4.165	4.115	4.443	....	....	....	....
Indianapolis	3.518	4.568	4.548	3.768	4.741	3.63	3.63	3.58	3.98	5.93	6.98	6.98	8.23
Birmingham	3.45	....	4.75	3.70	....	3.55	3.55	3.50	4.43	....	....	....	....
Memphis	3.965[7]	4.66	5.265	4.215	....	4.065	4.065	4.015	4.33	....	....	....	....
New Orleans	4.058*	5.079	5.358	4.308	....	4.158	4.158*	4.108*	4.629	....	....	....	....
Houston	3.763	5.573	6.313[1]	4.313	..	4.25	4.25	3.75	6.373[3]	7.223	8.323	8.323	9.373
Los Angeles	5.00	7.20[3]	6.10[4]	4.95	5.613[15]	4.95	4.65	4.40	5.583	8.204	9.404	9.304	10.454
San Francisco	4.55[14]	7.30[4]	6.354	4.50[14]	7.333[17]	4.65[14]	4.35[14]	4.15[14]	5.333	8.304	9.404	9.404	10.454
Seattle	4.65[12]	7.05[4]	5.954	4.25[12]	..	4.75[12]	4.45[12]	4.35[12]	5.783	....	9.404	....	....
Portland	4.65[11]	6.60[4]	5.754	4.75[11]	..	4.85[11]	4.45[11]	4.45[11]	5.533	8.304	9.404	8.304	9.404
Salt Lake City	4.530[17]	....	6.171[3]	5.53[17]	....	4.98[17]	4.98[17]	4.88[17]	5.90	....	....	....	....

National Emergency Steels

MILL EXTRAS

Designation	Basic Open-Hearth		Electric Furnace		Designation	Basic Open-Hearth		Electric Furnace	
	Bars and Bar-Strip	Billets, Blooms, and Slabs	Bars and Bar-Strip	Billets, Blooms, and Slabs		Bars and Bar-Strip	Billets, Blooms, and Slabs	Bars and Bar-Strip	Billets, Blooms, and Slabs
NE 8612	0.65¢	$13.00	$1.15	$23.00	NE 9427	0.75¢	$15.00	$1.25	$25.00
NE 8615	0.65	13.00	1.15	23.00	NE 9430	0.75	15.00	1.25	25.00
NE 8617	0.65	13.00	1.15	23.00	NE 9432	0.75	15.00	1.25	25.00
NE 8620	0.65	13.00	1.15	23.00	NE 9435	0.75	15.00	1.25	25.00
NE 8622	0.65	13.00	1.15	23.00	NE 9437	0.75	15.00	1.25	25.00
NE 8625	0.65	13.00	1.15	23.00	NE 9440	0.75	15.00	1.25	25.00
NE 8627	0.65	13.00	1.15	23.00	NE 9442	0.80	16.00	1.30	26.00
NE 8630	0.65	13.00	1.15	23.00	NE 9445	0.80	16.00	1.30	26.00
NE 8632	0.65	13.00	1.15	23.00	NE 9447	0.80	16.00	1.30	26.00
NE 8635	0.65	13.00	1.15	23.00	NE 9450	0.80	16.00	1.30	26.00
NE 8637	0.65	13.00	1.15	23.00					
NE 8640	0.65	13.00	1.15	23.00					
NE 8642	0.65	13.00	1.15	23.00	NE 9722	0.65	13.00	1.15	23.00
NE 8645	0.65	13.00	1.15	23.00	NE 9727	0.65	13.00	1.15	23.00
NE 8647	0.65	13.00	1.15	23.00	NE 9732	0.65	13.00	1.15	23.00
NE 8650	0.65	13.00	1.15	23.00	NE 9737	0.65	13.00	1.15	23.00
					NE 9742	0.65	13.00	1.15	23.00
					NE 9745	0.65	13.00	1.15	23.00
NE 8712	0.70	14.00	1.20	24.00	NE 9747	0.65	13.00	1.15	23.00
NE 8715	0.70	14.00	1.20	24.00	NE 9750	0.65	13.00	1.15	23.00
NE 8717	0.70	14.00	1.20	24.00	NE 9763	0.65	13.00	1.15	23.00
NE 8720	0.70	14.00	1.20	24.00	NE 9768	0.65	13.00	1.15	23.00
NE 8722	0.70	14.00	1.20	24.00					
NE 8725	0.70	14.00	1.20	24.00					
NE 8727	0.70	14.00	1.20	24.00	NE 9830	1.30	26.00	1.80	36.00
NE 8730	0.70	14.00	1.20	24.00	NE 9832	1.30	26.00	1.80	36.00
NE 8732	0.70	14.00	1.20	24.00	NE 9836	1.30	26.00	1.80	36.00
NE 8735	0.70	14.00	1.20	24.00	NE 9837	1.30	26.00	1.80	36.00
NE 8737	0.70	14.00	1.20	24.00	NE 9840	1.30	26.00	1.80	36.00
NE 8740	0.70	14.00	1.20	24.00	NE 9842	1.30	26.00	1.80	36.00
NE 8742	0.70	14.00	1.20	24.00	NE 9845	1.30	26.00	1.80	36.00
NE 8745	0.70	14.00	1.20	24.00	NE 9847	1.30	26.00	1.80	36.00
NE 8747	0.70	14.00	1.20	24.00	NE 9850	1.30	26.00	1.80	36.00
NE 8750	0.70	14.00	1.20	24.00					
					NE 9912	1.20	24.00	1.55	31.00
NE 9415	0.75	15.00	1.25	25.00	NE 9915	1.20	24.00	1.55	31.00
NE 9417	0.75	15.00	1.25	25.00	NE 9917	1.20	24.00	1.55	31.00
NE 9420	0.75	15.00	1.25	25.00	NE 9920	1.20	24.00	1.55	31.00
NE 9422	0.75	15.00	1.25	25.00	NE 9922	1.20	24.00	1.55	31.00
NE 9425	0.75	15.00	1.25	25.00	NE 9925	1.20	24.00	1.65	31.00

Note 1: The ranges shown are restricted to sizes 100 sq. in. or less or equivalent cross-sectional area 18 in. wide or under with a maximum individual piece weight of 7000 lb. irrespective of size. Note 2: For steels ordered to such ranges, below the size and weight restriction, the average of all the chemical checks must be within the limits specified subject to check analysis variations given in Table 4, Section 10, AISI Steel Products Manual. Note 3: When acid open-hearth is specified and acceptable, add to basic open-hearth alloy differential 0.25c. per lb. for bars and bar strip and $5 per gross ton for billets, blooms and slabs. Note 4: The extras shown are in addition to the base price of $2.70 for 100 lb. on finished products and $54 per gross ton on semi-finished steel, major basing points, and are in cents per pound when applicable to bars and bar-strip and in dollars per gross ton when applicable to billets, blooms and slabs. The full extra applicable over the base price is the total of all extras indicated by the specific requirements of the order. The higher extra shall be charged for any size falling between two published extras.

BASE QUANTITIES

Standard unless otherwise keyed on prices.

HOT ROLLED: Sheets, strip, plates, shapes and bars, 400 to 1999 lb.

COLD ROLLED: Sheets, 400 to 1499 lb.; strip, extras on all quantities; bars, 1500 lb. base.

NE ALLOY BARS: 1000 to 39,999 lb.

EXCEPTIONS: (1) 150 to 499 lb. (2) 150 to 1499 lb. (3) 400 to 1499 lb. (4) 450 to 1499 lb. (5) 500 to 1499 lb. (6) 0 to 199 lb. (7) 400 to 1499 lb. (8) 1000 to 1999 lb. (9) 450 to 3749 lb. (10) 400 to 3999 lb. (11) 300 to 4999 lb. (12) 300 to 10,000 lb. (13) 400 to 14,999 lb. (14) 400 lb. and over. (15) 1000 lb. and over. (16) 1500 lb. and over. (17) 2000 lb. and over. (18) 3500 lb. and over.

(a) Philadelphia: Galvanized sheet, 25 or more bundles.

Extra for size, quality, etc., apply on above quotations.

*Add 0.271c. for sizes not rolled in Birmingham.

**City of Philadelphia only. Applicable freight rates must be added to basing point prices to obtain delivered price to other localities in metropolitan area.

LAKE SUPERIOR ORES

(51.50% *Fe, Natural Content, Delivered Lower Lake Ports**)

	Per Gross Ton
Old range, bessemer, 51.50	$4.75
Old range, non-bessemer, 51.50	4.60
Mesaba, bessemer, 51.50	4.60
Mesaba, non-bessemer, 51.50	4.45
High phosphorus, 51.50	4.35

*Adjustments are made to indicate prices based on variance of Fe content of ores as analyzed on a dry basis by independent laboratories.

FLUORSPAR

Maximum price f.o.b. consumer's plant, $30 per short ton plus either (1) rail freight from producer to consumer, or (2) rail freight from Rosiclare, Ill., to consumer, whichever is lower.

Exception

When the WPB Steel Division certifies in writing the consumer's need for one of the higher grades of metallurgical fluorspar specified in the table below the price shall be taken from the table plus items (1 and 2) from paragraph above.

Effective CaF_2 Content:	*Base price per short ton*
70% or more	$33.00
65% but less than 70%	32.00
60% but less than 65%	31.00
Less than 60%	30.00

PRICES

WELDED PIPE AND TUBING

Base discounts, f.o.b. Pittsburgh district and Lorain, Ohio, mills

(F.o.b. Pittsburgh only on wrought pipe) base price—$200.00 per net ton

Steel (buttweld)

	Black	Galv.
½-in.	63½	51
¾-in.	66½	55
1-in. to 3-in.	68½	57½

Wrought Iron (buttweld)

½-in.	24	3½
¾-in.	30	10
1-in. and 1¼-in.	34	16
1½-in.	38	18½
2-in.	37½	18

Steel (lapweld)

2-in.	61	49½
2½-in. and 3-in.	64	52½
3½-in. to 6-in.	66	54½

Wrought Iron (lapweld)

2-in.	30½	12
2½-in. to 3½-in.	31½	14½
4-in.	33½	18
4½-in. to 8-in.	32½	17

Steel (butt, extra strong, plain ends)

½-in.	61½	50½
¾-in.	65½	54½
1-in. to 3-in.	67	57

Wrought Iron (same as above)

½-in.	25	6
¾-in.	31	12
1-in. to 2-in.	38	19½

Steel (lap, extra strong, plain ends)

2-in.	59	48½
2½-in. and 3-in.	63	52½
3½-in. to 6-in.	66½	56

Wrought Iron (same as above)

2-in.	33½	15½
2½-in. to 4-in.	39	22½
4½-in. to 6-in.	37½	21

On buttweld and lapweld steel pipe jobbers are granted a discount of 5 pct. On l.c.l. shipments prices are determined by adding 25 pct and 30 pct and the carload freight rate to the base card.

F.o.b. Gary prices are two points lower discount or $4 a ton higher than Pittsburgh or Lorain on lapweld and one point lower discount, or $2 a ton higher on all buttweld.

CAST IRON WATER PIPE

	per net ton
6-in. and larger, del'd Chicago	$54.80
6-in. and larger, del'd New York	52.20
6-in. and larger, Birmingham	46.00
6-in. and larger f.o.b. cars, San Francisco or Los Angeles	69.40
6-in. and larger f.o.b. cars, Seattle	71.20

Class "A" and gas pipe, $3 extra; 4-in. pipe is $3 a ton above 6-in. Prices shown are for lots of less than 200 tons. For 200 tons or over, 6-in. and larger are $45 at Birmingham and $53.80 delivered Chicago, $59.40 at San Francisco and Los Angeles, and $70.20 at Seattle. Delivered prices do not reflect 3 pct tax on freight rates.

BOILER TUBES

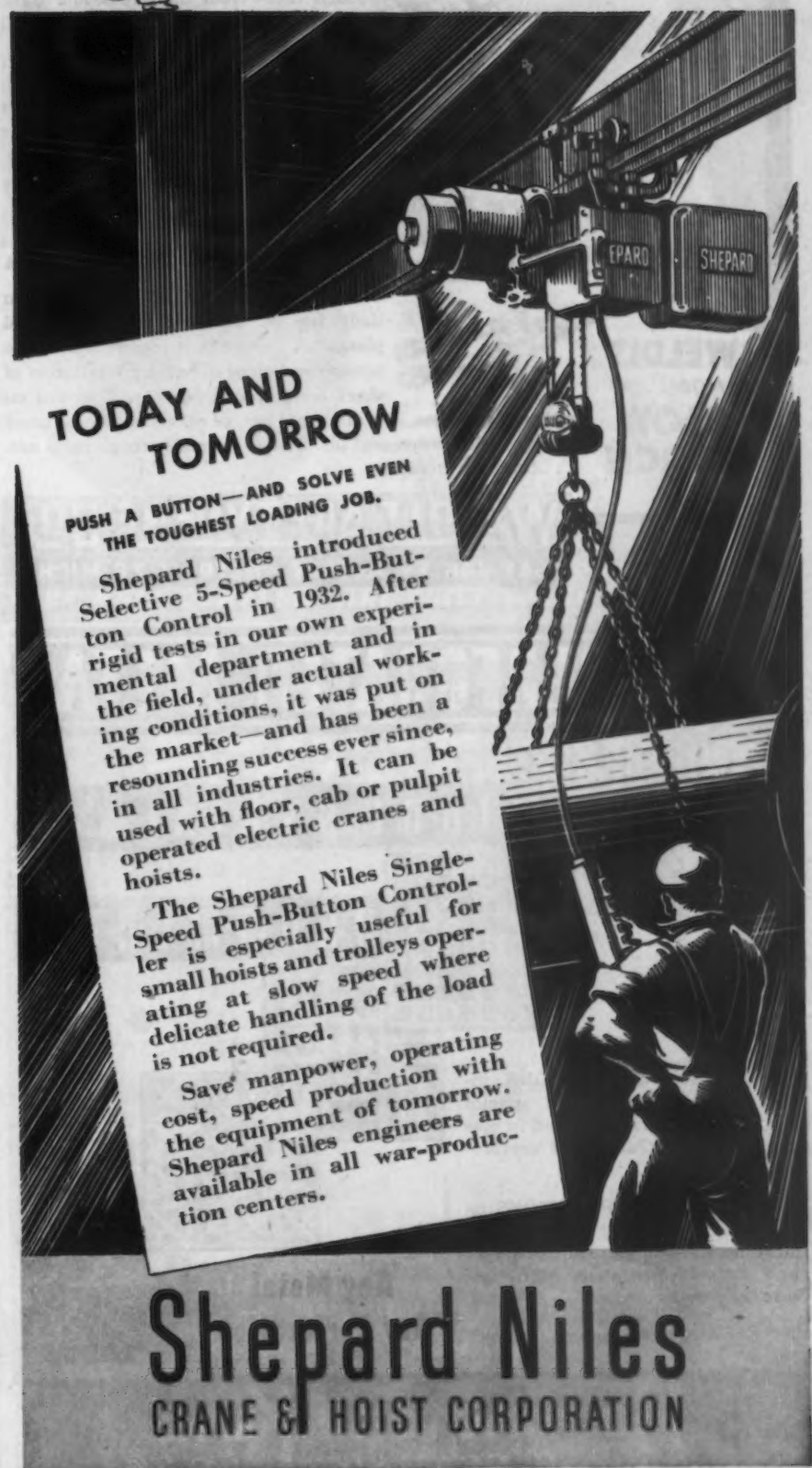
Seamless steel and lapweld commercial boiler tubes and locomotive tubes, Minimum wall. Net base prices per 100 ft f.o.b. Pittsburgh, in carload lots.

	Seamless Cold Drawn	*Seamless Hot Rolled*	*Lap Weld, Hot Rolled*
2 in. O.D. 13 B.W.G.	15.03	13.04	12.38
2½ in. O.D. 12 B.W.G.	20.21	17.54	16.58
3 in. O.D. 12 B.W.G.	22.48	19.50	18.35
3½ in. O.D. 11 B.W.G.	28.37	24.62	23.15
4 in. O.D. 10 B.W.G.	35.20	30.54	28.66

(Extras for less carload quantities)

40,000 lb or ft and over	Base
30,000 lb or ft to 39,999 lb or ft	5 pct
20,000 lb or ft to 29,999 lb or ft	10 pct
10,000 lb or ft to 19,999 lb or ft	20 pct
5,000 lb or ft to 9,999 lb or ft	30 pct
2,000 lb or ft or 4,999 lb or ft	45 pct
Under 2,000 lb or ft	65 pct

ONLY YESTERDAY...



TODAY AND TOMORROW

PUSH A BUTTON—AND SOLVE EVEN THE TOUGHEST LOADING JOB.

Shepard Niles introduced Selective 5-Speed Push-Button Control in 1932. After rigid tests in our own experimental department and in the field, under actual working conditions, it was put on the market—and has been a resounding success ever since, in all industries. It can be used with floor, cab or pulpit operated electric cranes and hoists.

The Shepard Niles Single-Speed Push-Button Controller is especially useful for small hoists and trolleys operating at slow speed where delicate handling of the load is not required.

Save manpower, operating cost, speed production with the equipment of tomorrow. Shepard Niles engineers are available in all war-production centers.

Shepard Niles
CRANE & HOIST CORPORATION

356 SCHUYLER AVE. • MONTOUR FALLS, N. Y.

Safe Welding

AT LOWER PRODUCTION COSTS

The Weldit Gasaver shuts off the welding flame when not in use. . . . Conserves essential materials by cutting oxygen and acetylene consumption as much as *fifty* per cent. Prevents injury to workmen—or sudden fires—from dangerous idle torch flames. . . . Adjustment remains unaltered between welds.

When the Weldit Gasaver has been installed, you simply hang idle torch on the handy lever rod. Weight of torch pulls rod down, thus automatically shutting off supply lines. Relight instantly by passing torch over Gasaver pilot light. No bother. . . . No time lost. . . . *No readjusting required.* . . . Price $10.00 at Detroit. Order today.

Better Soldering, Annealing and Heating Jobs

The Weldit Model CW Blowpipe is in daily use by many foremost industrial plants. . . . Built in accordance with the recommendations of leading fabricators of sheet metal products. . . . Operates on either natural gas, manufactured gas, or other low temperature fuel gas and compressed air. Stands up under rough shop use. . . . Send for literature.

WELDIT ACETYLENE CO.
641 BAGLEY AVENUE • DETROIT 26, MICH.

PERFORATED METAL

INDUSTRIAL and ORNAMENTAL

INDUSTRIAL PERFORATIONS include round, square and special shaped perforations as used in mechanical arts. Our line is comprehensive.

ORNAMENTAL PERFORATIONS as used in architectural grilles, metal furniture, enclosures, cabinets, stoves and for ornamentation. Many attractive and exclusive patterns.

H & K workmanship is unsurpassed.

Any Metal
Any Perforation

The Harrington & King PERFORATING CO.

5657 FILLMORE STREET, CHICAGO 44, ILL. Eastern Office: 114 Liberty Street, New York 6, N. Y.

PRICES

CORROSION AND HEAT-RESISTING STEEL

(Per lb. base price, f.o.b. Pittsburgh)

Chromium-Nickel Alloys

	No. 304	No. 302
Forging billets	21.25c.	20.40c.
Bars	25.00c.	24.00c.
Plates	29.00c.	27.00c.
Structural shapes	25.00c.	24.00c.
Sheets	36.00c.	34.00c.
Hot rolled strip	23.50c.	21.50c.
Cold rolled strip	30.00c.	28.00c.
Drawn wire	25.00c.	24.00c.

Straight-Chromium Alloys

	No. 410	No. 430	No. 442	No. 446
F.Billets	15.725c.	16.15c.	19.125c.	23.375c.
Bars	18.50c.	19.00c.	22.50c.	27.50c.
Plates	21.50c.	22.00c.	25.50c.	30.50c.
Sheets	26.50c.	29.00c.	32.50c.	36.50c.
Hot strip	17.00c.	17.50c.	24.00c.	35.00c.
Cold strip	22.00c.	22.50c.	32.00c.	52.00c.

Chromium-Nickel Clad Steel (20%)

	No. 304
Plates	18.00c.*
Sheets	19.00c.

*Includes annealing and pickling.

REFRACTORIES

(F.o.b. Works)

Fire Clay Brick

	Per 1000
Super-duty brick, St. Louis	$68.55
First quality, Pa., Md., Ky., Mo., Ill.	54.45
First quality, New Jersey	59.45
Sec. quality, Pa., Md. Ky., Mo., Ill.	49.40
Sec. quality, New Jersey	54.15
No. 1 Ohio	45.75
Ground fire clay, net ton	8.05

Silica Brick

Pennsylvania and Birmingham	$54.45
Chicago District	62.45
Silica cement, net ton (Eastern)	9.55

Chrome Brick

	Per Net Ton
Standard chemically bonded, Balt., Plymouth Meeting, Chester	$54.00

Magnesite Brick

Standard, Balt. and Chester	$76.00
Chemically bonded, Baltimore	65.00

Grain Magnesite

Domestic, f.o.b. Balt. and Chester in sacks (carloads)	$43.48
Domestic, f.o.b. Chewelah, Wash. (in bulk)	22.00

EXCEPTIONS TO RPS 6

Ingots, carbon, rerolling—Phoenix Iron Co. may charge $38.75; Kaiser Co., $43.00 f.o.b. Pacific Coast ports; Empire Sheet & Tinplate Co., $34.25; Pgh. Steel Co., $33.10. Granite City Steel, $39.45.

Ingots, carbon, forging—Phoenix Iron Co. may charge $43.00; Empire Sheet & Tinplate Co., $39.25, f.o.b. Mansfield, Ohio; West Coast producers, $48.00, f.o.b. Pacific Coast Ports; Pgh. Steel Co., $38.10.

Ingots, alloy—C/l delivered Detroit add $2.00; delivered East Michigan add $3.00. Connors Steel Co. may charge $45.00 f.o.b. Birmingham.

Slabs, per gross ton—Andrews Steel Co. $41 basing pts.; Wheeling Steel Corp. (rerolling) 4 in. sq. or larger $37.75 f.o.b. Portsmouth, Ohio; Empire Sheet & Tin Plate Corp. $41; Phoenix Iron Co. (rerolling) $41, (forging) $47; Granite City Steel $47.50; Kaiser Co., (rerolling) $58.64, (forging) $64.64, f.o.b. Los Angeles.

Blooms, per gross ton—Phoenix Iron Co. (rerolling) $41; (forging) $47; Pgh. Steel Co. (rerolling) $38.25, (forging) $44.25; Wheeling Steel Corp. (rerolling) 4 in. sq. or larger $37.75 f.o.b. Portsmouth; Kaiser Co. (rerolling) $58.64, (forging) $64.64 (shell steel) $74.64 f.o.b. Los Angeles.

Sheet Bar, per gross ton—Empire Sheet & Tinplate Co. $39 mill; Wheeling Steel Corp. $38 Portsmouth, Ohio.

Billets, Forging, per gross ton—Andrews Steel Co. $50 basing pts.; Follansbee Steel Corp. $49.50 Toronto, Ohio; Phoenix Iron Co. $47 mill; Geneva Steel Co. $64.64 f.o.b. Pacific Coast; Pittsburgh Steel Co. $49.50; Kaiser Co. $64.64, (shell steel) $74.64, f.o.b. Los Angeles.

PRICES

Billets, Rerolling, per gross ton—Continental Steel Corp. may charge Acme Steel in Chicago switching area $34 plus freight from Kokomo, Ind.; Northwestern Steel & Wire Co. (Lend-Lease) $41 mill; Wheeling Steel Corp. 4 in. sq. or larger $37.75, smaller $39.50 f.o.b. Portsmouth, Ohio; Stanley Works may sell Washburn Wire Co. under allocation at $39 Bridgeport, Conn.; Keystone Steel & Wire Co. may sell Acme Steel Co. at Chicago base, f.o.b. Peoria; Phoenix Iron Co. $41 mill; Continental Steel Corp. (1¾ x 1¾) $39.50, (2 x 2) $40.60 Kokomo, Ind. (these prices include $1 size extra); Keystone Steel & Wire Co. $36.40 Peoria; Connors Steel Co. $50.60 Birmingham; Ford Motor Co. $34 Dearborn, Mich.; Geneva Steel Co. $58.64 f.o.b. Pacific Coast; Pgh. Steel Co. $43.50; Kaiser Co. $58.64 f.o.b. Los Angeles.

Structural Shapes—Phoenix Iron Co. 2.35c. basing pts. (export) 2.50c. Phoenixville; Knoxville Iron Co. 2.30c. basing points; Kaiser Co. 3.20c. f.o.b. Los Angeles.

Rails, per gross ton—Sweet Steel Co. (rail steel) $50 mill; West Virginia Rail Co. (lightweight) on allocation based Huntington, W. Va.; Colorado Fuel & Iron, $45 Pueblo.

Hot Rolled Plate—Granite City Steel Co. 2.85c. produced on DPC eqpt., 2.35c. otherwise; Knoxville Iron Co. 2.25c. basing pts.; Kaiser Co. and Geneva Steel Co. 3.20c. Pacific Ports; Central Iron and Steel Co. 2.50c. basing points; Granite City Steel Co. 2.35c. Granite City.

Merchant Bars—W. Ames Co., 10 tons and over, 2.85c. mill; Eckels-Nye Steel Corp. 2.50c. basing pts. (rail steel) 2.40c.; Phoenix Iron Co. 2.40c. basing pts.; Sweet Steel Co. (rail steel) 2.33c. mill; Joslyn Mfg. & Supply Co., 2.35c. Chicago; Calumet Steel Div., Borg Warner Corp. (8 in. mill bar), 2.35c. Chicago; Knoxville Iron Co., 2.30c. basing pts.; Laclede Steel Co., sales to LaSalle Steel granted Chicago base, f.ob Madison, Ill.; Milton Mfg. Co., 2.75c. f.o.b. Milton, Pa.

Pipe Skelp—Wheeling Steel, Benwood, 2.05c.

Reinforcing Bars—W. Ames & Co., 10 tons and over, 2.85c. mill; Sweet Steel Co. (rail steel), 2.33c. mill; Columbia Steel Co., 2.50c. Pacific Ports.

Cold Finished Bars—Keystone Drawn Steel Co. on allocation, Pittsburgh c.f. base plus c/l freight on hot rolled bars Pittsburgh to Spring City, Pa.; New England Drawn Steel Co. on allocation outside New England, Buffalo c.f. base plus c/l freight Buffalo to Mansfield, Mass., f.o.b. Mansfield; Empire Finished Steel Corp. on allocation outside New England, Buffalo c.f. base plus c/l freight Buffalo to plants, f.o.b. plant; Compressed Steel Shafting Co. on allocation outside New England, Buffalo base plus c/l freight Buffalo to Readville, Mass., f.o.b. Readville; Medart Co. in certain areas, Chicago c.f. base plus c/l freight Chicago to St. Louis, f.o.b. St. Louis.

Alloy Bars—Texas Steel Co., for delivery except Texas and Okla., Chicago base, f.o.b. Fort Worth, Tex.; Connors Steel Co., shipped outside Ala., Mississippi, Louisiana, Georgia, Florida, Tenn., Pittsburgh base, f.o.b. Birmingham.

Hot Rolled Strip—Joslyn Mfg. & Supply Co., 2.30c. Chicago; Knoxville Iron Co., 2.25c. basing pts.

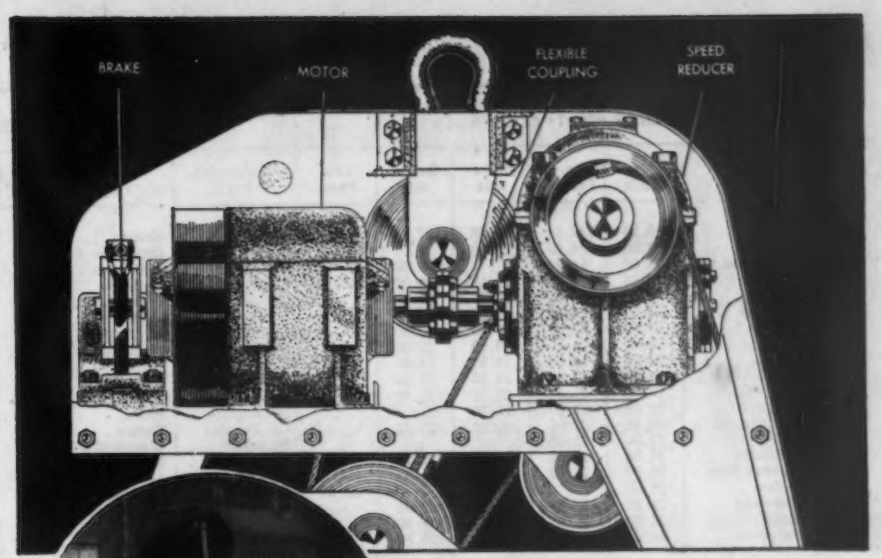
Hot Rolled Sheets—Andrews Steel Co., Middletown base on shipments to Detroit or area; Parkersburg Iron & Steel, 2.25c. Parkersburg. Granite City Steel 2.43c.

Galvanized Sheets—Andrews Steel Co., 3.75c. basing pts.; Parkersburg Iron & Steel Co., 3.85c. Parkersburg; Continental Steel Co., Middletown base on Kokomo, Ind., product; Superior Sheet Steel Co., Pittsburgh base except for Lend-Lease.

Pipe and Tubing—South Chester Tube Co. when priced at Pittsburgh, freight to Gulf Coast and Pacific Ports may be charged from Chester, Pa., also to points lying west of Harrisburg, Pa.

Black Sheets—Empire Sheet and Tinplate Co., maximum base price mill is 2.45c. per 100 lb., with differentials, transportation charges, etc., provided in RPS. No. 6.

Wire Products—Pittsburgh Steel Co., f.o.b. Pittsburgh, per 100 lb., rods, No. 5 to 9/32 in., 2.20c.; rods, heavier than 9/32, 2.35c.; bright wire, 2.725c.; bright nails, 2.90c.; lead and furnace annealed wire, 2.85c.; pot annealed wire, 2.85c.; galvanized barbed wire, 3.90c.; plain staples, 2.55c.; galvanized staples, 2.65c.; bright spring wire, 3.30c.; galvanized spring wire, 3.45c.



HOOK 'ER ON—PLUG 'ER IN

ABOVE YOU SEE WHY the Erie Electric Bucket works in its own headroom controlled from the crane cab. This sturdily constructed bucket needs only to be hooked over the crane hook and power line plugged in. The man in the cab controls the opening of the bucket from cracking the lips to any degree of opening or closing. The extra in-built weight permits easy penetration. *Write for complete particulars.*

ERIE STEEL CONSTRUCTION CO
858 GEIST ROAD . ERIE PA

ERIE BUCKETS
THE MOST COMPLETE LINE BUILT

» ALSO AGGREMETERS
ELECTRIC OVERHEAD CRANES
PORTABLE CONCRETE PLANTS

JOHNSON *Wire*

Shapes

Round—Half Round Oval
Flat—Triangular and
Special Shapes

Finishes

Bright-Coppered
Liquor Finish
Bronze Plated
Tinned—Cadmium
Bright Galvanized
Oil Tempered Round
Flat and Shaped Wires

JOHNSON STEEL & WIRE CO., INC.
WORCESTER 1, MASSACHUSETTS
NEW YORK AKRON CHICAGO LOS ANGELES

PIG IRON PRICES

BASING POINT* BASE PRICES

Basing Point	Basic	No. 2 Foundry	Malleable	Bessemer	Low Phos.
Bethlehem	$25.50	$26.00	$26.50	$27.00	.....
Birdsboro	25.50	26.00	26.50	27.00	$30.50
Birmingham	20.00	21.38	.....	26.00	.....
Buffalo	24.00	25.00	25.50	26.00	30.50
Chicago	24.50	25.00	25.00	25.50	.....
Cleveland	24.50	25.00	25.00	25.50	.....
Detroit	24.50	25.00	25.00	25.50	.....
Duluth	25.00	25.50	25.50	26.00	.....
Erie	24.50	25.00	25.50	26.00	.....
Everett	25.50	26.00	26.50	27.00	.....
Granite City	24.50	25.00	25.00	25.50	.....
Hamilton	24.50	25.00	25.00	.....	.....
Neville Island	24.50	25.00	25.00	25.50	.....
Provo	22.50	23.00	.....	.....	.....
Sharpsville[1]	24.50	25.00	25.00	25.50	.....
Sparrows Point	25.50	26.00	.....	.....	.....
Steelton	25.50	.....	.....	.....	30.50
Swedeland	25.50	26.00	26.50	27.00	.....
Toledo	24.50	25.00	25.00	25.50	.....
Youngstown	24.50	25.00	25.00	25.50	.....

DELIVERED PRICES† (BASE GRADES)

Consuming Point	Basing Point	Freight Rate	Basic	No. 2 Foundry	Malleable	Bessemer	Low Phos.
Boston	Everett	$ .50	$26.00	$26.50	$27.00	$27.50	.....
Boston	Birdsboro-Steelton	4.02	.....	.....	.....	.....	$34.52
Brooklyn	Bethlehem	2.50	26.00	26.50	29.00	29.50	.....
Brooklyn	Birdsboro	2.92	.....	.....	.....	.....	33.42
Canton	Cleveland	1.39	25.89	26.39	26.39	26.89	.....
Canton	Buffalo	3.19	.....	.....	.....	.....	33.69
Cincinnati	Birmingham	4.06	24.06	25.44	.....	.....	.....
Cincinnati	Hamilton	1.11	.....	.....	26.11	.....	.....
Cincinnati	Buffalo	4.40	.....	.....	.....	.....	34.90
Jersey City	Bethlehem	1.53	27.03	27.53	28.03	28.53	.....
Jersey City	Birdsboro	1.94	.....	.....	.....	.....	32.44
Los Angeles	Provo	4.95	27.45	27.95	.....	.....	.....
Los Angeles	Buffalo	15.41	.....	.....	.....	.....	45.91
Mansfield	Cleveland & Toledo	1.94	26.44	26.94	26.94	27.44	.....
Mansfield	Buffalo	3.36	.....	.....	.....	.....	33.86
Philadelphia	Swedeland	.84	26.34	26.84	27.34	27.84	.....
Philadelphia	Birdsboro	1.24	.....	.....	.....	.....	31.74
San Francisco	Provo	4.95	27.45	27.95	.....	.....	.....
San Francisco	Buffalo	15.41	.....	.....	.....	.....	45.91
Seattle	Provo	4.95	27.45	27.95	.....	.....	.....
Seattle	Buffalo	15.41	.....	.....	.....	.....	45.91
St. Louis	Granite City	.50	25.00	25.50	25.50	26.00	.....
St. Louis	Buffalo	7.07	.....	.....	.....	.....	37.57

* Maximum per gross ton, established by OPA February 14, 1945. † Prices do not reflect 3 per cent tax on freight.

(1) Struthers Iron & Steel Co., Struthers, Ohio, may charge 50c. a ton in excess of basing point prices for No. 2 foundry, basic, bessemer and malleable.

Charcoal pig iron base prices for Lyles, Tenn., and Lake Superior furnaces, $33.00 and $34.00, respectively. Newberry Brand of Lake Superior charcoal iron $39.00 per g.t., f.o.b. furnace, by order L 39 to RPS 10, April 11, 1945, retroactive to March 7, 1945. Delivered to Chicago, $42.34. High phosphorus iron sells at Lyles, Tenn., at $28.50.

Basing point prices are subject to switching charges; Silicon differentials (not to exceed 50c. a ton for each 0.25 per cent silicon content in excess of base grade which is 1.75 to 2.25 per cent); Phosphorus differentials, a reduction of 38c. per ton for phosphorus content of 0.70 per cent and over; Manganese differentials, a charge not to exceed 50c. per ton for each 0.50 per cent manganese content in excess of 1.00 per cent. Effective March 3, 1943, $2 per ton extra may be charged for 0.5 to 0.75 per cent nickel content and $1 per ton extra for each additional 0.25 per cent nickel.

Silvery iron and bessemer ferrosilicon up to and including 14.00 per cent silicon covered by RPS 10 as amended Feb. 14, 1945. Silvery iron, silicon 6.00 to 6.50 per cent, C/L per G.T., f.o.b. Jackon, Ohio—$30.50; f.o.b. Buffalo—$31.75. Add $1.00 per ton for each additional 0.50% Si. Add 50c. per ton for each 0.50% Mn over 1.00%. Add $1.00 per ton for 0.75% or more P. Bessemer ferrosilicon prices are $1.00 per ton above silvery iron prices of comparable analysis.

METAL POWDERS

Prices are based on current market prices of ingots plus a fixed figure. F.o.b. shipping point, ¢ per lb, ton lots.

Copper, electrolytic, 150 and 200 mesh	21½¢ to 23½¢
Copper, reduced, 150 and 200 mesh	20½¢ to 25½¢
Iron, commercial, 100 and 200 mesh 96 + % Fe	12½¢ to 15¢
Iron, crushed, 200 mesh and finer, 90 + % Fe carload lots	4¢
Iron, hydrogen reduced, 300 mesh and finer, 98½ + % Fe, drum lots	63¢
Iron, electrolytic, unannealed, 300 mesh and coarser, 99 + % Fe	30 to 33¢
Iron, electrolytic, annealed minus 100 mesh, 99 + % Fe	42¢
Iron carbonyl, 300 mesh and finer, 98-99.8 + % Fe	90¢
Aluminum, 100 and 200 mesh	*25¢
Antimony, 100 mesh	30¢
Cadmium, 100 mesh	$1.40
Chromium, 100 mesh and finer	$1.25
Lead, 100, 200 & 300 mesh	11½ to 15¢
Manganese	65¢
Nickel, 150 mesh	51½¢
Solder powder, 100 mesh	8½¢ plus metal
Tin, 100 mesh	58¾¢
Tungsten metal powder, 98%-99%, any quantity, per lb	$2.60
Molybdenum powder, 99%, in 200-lb kegs, f.o.b. York, Pa., per lb	$2.60
Under 100 lb	$3.00

*Freight allowed east of Mississippi.

COKE

Furnace, beehive (f.o.b. oven)	Net Ton
Connellsville, Pa.	$7.50*
Foundry, beehive (f.o.b. oven)	
Fayette Co., W. Va.	8.10
Connellsville, Pa.	9.00
Foundry, By-Product	
Chicago, del'd	13.35
Chicago, f.o.b.	12.60
New England, del'd	14.25
Kearny, N. J., f.o.b.	12.65
Philadelphia, del'd	12.85
Buffalo, del'd	13.00
Portsmouth, Ohio, f.o.b.	11.10
Painesville, Ohio, f.o.b.	11.75
Erie, del'd	12.75
Cleveland, del'd	12.80
Cincinnati, del'd	12.85
St. Louis, del'd	13.35
Birmingham, del'd	10.50

*Hand drawn ovens using trucked coal permitted to charge $8.00 per ton plus transportation charges.

GEAR TESTS
made with plastic models

Actual observation of *why* and *how* a gear tooth fails under excessive load is possible with Photoelastic equipment and plastic gear models now being used by Fairfield in research work on the strength of gears.

This is a visual check on the findings made by use of formulae, and a distinct advance in the science of gear making. A polarized light is passed through transparent gear models and the image on the screen shows in color the lines of stress which develop; permanent records are made by substituting a camera for the screen.

Gears are a primary factor in machinery, and Fairfield, backed by 25 years of experience, plus scientific research and modern inspection methods, can be relied upon to build into gears that superior quality essential for satisfactory use.

In anticipation of future production, investigate Fairfield facilities for making fine gears—write for our brochure on gears.

FAIRFIELD MFG. CO.

305 So. Earl Avenue
Lafayette, Ind.

ARMY E NAVY

FAIRFIELD for FINE GEARS

PRICES

BOLTS, NUTS, RIVETS, SET SCREWS

Bolts and Nuts

(F.o.b. Pittsburgh, Cleveland, Birmingham or Chicago)

Machine and Carriage Bolts:

Base discount less case lots

	Per Cent Off List
½ in. & smaller x 6 in. & shorter	65½
9/16 & ⅝ in. x 6 in. & shorter	63½
¾ to 1 in. x 6 in. & shorter	61
1⅛ in. and larger, all lengths	59
All diameters over 6 in. long	59
Lag, all sizes	62
Plow bolts	65

Nuts, Cold Punched or Hot Pressed

(Hexagon or Square)

⅝ in. and smaller	62
9/16 to 1 in. inclusive	59
1⅛ to 1½ in. inclusive	57
1⅝ in. and larger	56

On above bolts and nuts, excepting plow bolts, additional allowance of 10 per cent for full container quantities. There is an additional 5 per cent allowance for carload shipments.

Semi-Fin. Hexagon Nuts	U.S.S.	S.A.E.
Base discount less keg lots		
7/16 in. and smaller	..	64
½ in. and smaller	62	..
½ in. through 1 in.	..	60
9/16 in. through 1 in.	59	..
1⅛ in. through 1½ in.	57	58
1⅝ in. and larger	56	..

In full keg lots, 10 per cent additional discount.

Stove Bolts	*Consumer*
Packages, nuts loose	71 and 10
In packages, with nuts attached	71
In bulk	80

On stove bolts freight allowed up to 65c. per 100 lb. based on Cleveland, Chicago, New York on lots of 200 lb. or over.

Large Rivets

(½ in. and larger)

	Base per 100 Lb.
F.o.b. Pittsburgh, Cleveland, Chicago, Birmingham	$3.75

Small Rivets

(7/16 in. and smaller)

	Per Cent Off List
F.o.b. Pittsburgh, Cleveland, Chicago, Birmingham	65 and 5

Cap and Set Screws	*Consumer Per Cent Off List*
Upset full fin, hexagon head cap screws, coarse or fine thread, up to and incl. 1 in. x 6 in.	64
Upset set screws, cup and oval points	71
Milled studs	46
Flat head cap screws, listed sizes	36
Fillister head cap, listed sizes	51

Freight allowed up to 65c. per 100 lb. based on Cleveland, Chicago or New York on lots of 200 lb. or over.

ROOFING TERNE PLATE

(F.o.b. Pittsburgh, 112 Sheets)

	20x14 in.	20x28 in.
8-lb. coating I.C.	$6.00	$12.00
15-lb. coating I.C.	7.00	14.00
20-lb. coating I.C.	7.50	15.00

ELECTRICAL SHEETS

(Base, f.o.b. Pittsburgh)

	Per Lb.
Field grade	3.30c.
Armature	3.65c.
Electrical	4.15c.
Motor	5.05c.
Dynamo	5.75c.
Transformer 72	6.25c.
Transformer 65	7.25c.
Transformer 58	7.75c.
Transformer 52	8.55c.

F.o.b. Granite City, add 10c. per 100 lb. on field grade to and including dynamo. Pacific ports add 75c. per 100 lb. on all grades.

BELLEVUE *Controlled Atmosphere* FURNACES

EVERY Bellevue furnace is designed and built for a specific job. Hundreds of furnaces and repeat orders in scores of plants is evidence enough that you can have complete confidence in Bellevue engineers to solve your heat treating problems. Send for complete details.

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2974 BELLEVUE AVENUE DETROIT, MICH.

80% *of all Small Shop Saws are "Marvels"!*

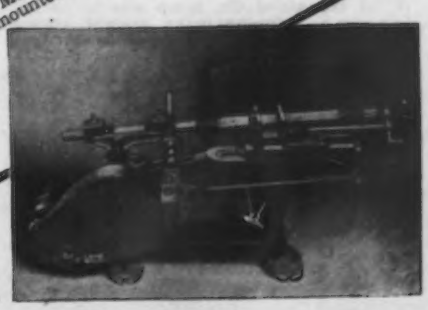
No. 1 Draw Cut Hack Saw Dry cut, sturdy saw well-known for its dependability, economy, and invaluable service in the small shop or shop department. Simple and efficient with low original, maintenance, and blade cost.

MARVEL SAWS

No. 2 Draw Cut Hack Saw. Companion to the No. 1 but with a normal 6" x 6" capacity which can be increased to 8" x 8" by shortening the stroke with adjustable crank. The No. 2 MARVEL also has a swivel vise which is removable from the "T" slotted bed. Permitting special fixtures to be mounted. Both machines are available in belt and motor driven models. Motor driven models can also be furnished mounted on portable truck.

Complete Range of Metal Sawing Machines

Being the largest exclusive manufacturer of metal sawing machines and blades, both hack saw and band saw type, we have the correct answer to your cut-off problems. Each MARVEL model has a distinct application, so write us and we will send our catalog, price, and recommendation for the saw to fill your requirements most efficiently. MARVEL sawing engineers are also available to discuss and analyze your cut-off work. (Without obligation of course)



ARMSTRONG-BLUM MFG. CO.
5700 W. Bloomingdale Ave., Chicago 39, Illinois, U. S. A.

Ferromanganese

78-82% Mn, maximum contract base price per gross ton, lump size, f.o.b. car at Baltimore, Philadelphia, New York, Birmingham, Rockdale, Rockwood, Tenn.

Carload lots (bulk)	$135.00
Carload lots (packed)	141.00
Less ton lots (packed)	148.50

$1.70 for each 1% above 82% Mn; penalty, $1.70 for each 1% below 78%.

Manganese Metal

Contract basis, lump size, per lb. of metal, f.o.b. shipping point with freight allowed. Spot sales add 2c. per lb.

96-98% Mn, .2% max. C, 1% max. Si, 2% max. Fe.

Carload, bulk	36c.
L.c.l. lots	38c.

95-97% Mn, .2% max. C, 1.5% max. Si, 2.5% max. Fe.

Carload, bulk	34c.
L.c.l. lots	35c.

Spiegeleisen

Maximum base, contract prices, per gross ton, lump, f.o.b. Palmerton, Pa.

	16-19% Mn 3% max. Si	19-21% Mn 3% max. Si
Carloads	$35.00	$36.00
Less ton	47.50	48.50

Electric Ferrosilicon

OPA maximum base price cents per lb. contained Si, lump size in carloads, f.o.b. shipping point with freight allowed.

	Eastern Zone	Central Zone	Western Zone
50% Si	6.65c.	7.10c.	7.25c.
75% Si	8.05c.	8.20c.	8.75c.
80-90% Si.	8.90c.	9.05c.	9.55c.
90-95% Si.	11.05c.	11.20c.	11.65c.

Spot sales add: 45c. per lb. for 50% Si, .3c. per lb. for 75% Si, .25c. per lb. for 80-90% and 90-95% Si.

Silvery Iron

Silvery Iron, Silicon 14.01 to 14.50 per cent, $45.50 per G. T. f.o.b. Jackson, Ohio. Add $1.00 per ton for each additional 0.50% Si up to and including 18%. Add $1.00 per ton for low impurities, not to exceed: P—0.05%, S—0.04%, C—1.00%. Covered by MPR 405.

Silicon Metal

OPA maximum base price per lb. of contained Si, lump size, f.o.b. shipping point with freight allowed to destination, for l.c.l. above 2000 lb., packed. Add .25c. for spot sales.

	Eastern Zone	Central Zone	Western Zone
96% Si, 2% Fe	13.10c.	13.55c.	16.50c.
97% Si, 1% Fe	13.45c.	13.90c.	16.80c.

Ferrosilicon Briquets

OPA maximum base price per lb. of briquet, bulk, f.o.b. shipping point with freight allowed to destination. Approximately 40% Si. Add .25c. for spot sales.

	Eastern Zone	Central Zone	Western Zone
Carload, bulk	3.35c.	3.50c.	3.65c.
2000 lb-carload	3.8c.	4.2c.	4.25c.

Silicomanganese

Contract basis lump size, per lb. of metal, f.o.b. shipping point with freight allowed. Add .25c. for spot sales. 65-70% Mn, 17-20% Si, 1.5% max. C.

Carload, bulk	6.05c.
2000 lb. to carload	6.70c.
Under 2000 lb.	6.90c.
Briquets, contract, basis carlots, bulk freight allowed, per lb.	5.80c.
2000 lb. to carload	6.30c.
Less ton lots	6.55c.

Ferrochrome

(65-72% Cr. 2% max. Si)

OPA maximum base contract prices per lb. of contained Cr, lump size in carload lots, f.o.b. shipping point, freight allowed to destination. Add .25c. per lb. contained Cr for spot sales.

	Eastern Zone	Central Zone	Western Zone
0.06% C	23.00c.	23.40c.	24.00c.
0.10% C	22.50c.	22.90c.	23.50c.
0.15% C	22.00c.	22.40c.	23.00c.
0.20% C	21.50c.	21.90c.	22.50c.
0.50% C	21.00c.	21.40c.	22.00c.
1.00% C	20.50c.	20.90c.	21.50c.
2.00% C	19.50c.	19.90c.	21.00c.
66-71% Cr, 4-10%	13.00c.	13.40c.	14.00c.
62-66% Cr, 5-7% C	13.50c.	13.90c	14.50c.

High-Nitrogen Ferrochrome

Low-carbon type: 67-72% Cr, 0.75% N. Add 2c. per lb. to regular low-carbon ferrochrome price schedule. Add 2c. for each additional 0.25% N. High-carbon type: 66-71% Cr, 4-5% C, 0.75% N. Add 5c. per lb. to regular high-carbon ferrochrome price schedule.

Low-Carbon Ferromanganese

Contract prices per lb. of manganese contained, lump size, f.o.b. shipping point, freight allowed to destination, Eastern Zone. Add 0.25c. for spot sales.

	Carloads, Bulk	Ton Lots	Less Ton
0.10% max. C, 1 or 2% max. Si	23.00c.	23.40c.	23.65c.
0.15% max. C, 1 or 2% max. Si	22.00c.	22.40c.	22.65c.
0.30% max. C, 1 or 2% max. Si	21.00c.	21.40c.	21.65c.
0.50% max. C, 1 or 2% max. Si	20.00c.	20.40c.	20.65c.
0.75% max. C, 7.00% max. Si	16.00c.	16.40c.	16.65c.

Ferrochrome Briquets

Contract prices per lb. of briquet, f.o.b. shipping point, freight allowed to destination. Approx. 60 per cent contained chromium. Add 0.25c. for spot sales.

	Eastern Zone	Central Zone	Western Zone
Carload, bulk	8.25c.	8.55c.	8.95c.
Ton lots	8.75c.	9.25c.	10.75c.
Less ton lots	9.00c.	9.50c.	11.00c.

Ferromanganese Briquets

Contract prices per lb. of briquet, f.o.b. shipping point, freight allowed to destination. Approx. 66 per cent contained manganese. Add 0.25c. for spot sales.

	Eastern Zone	Central Zone	Western Zone
Carload, bulk	6.05c.	6.30c.	6.60c.
Ton lots	6.65c.	7.55c.	8.55c.
Less ton lots	6.80c.	7.80c.	8.80c.

Calcium—Manganese—Silicon

Contract prices per lb. of alloy, lump size, f.o.b. shipping point, freight allowed to destination.

16-20% Ca, 14-18% Mn, 53-59% Si. Add 0.25c. for spot sales.

	Eastern Zone	Central Zone	Western Zone
Carloads	15.50c.	16.00c.	18.05c.
Ton lots	16.50c.	17.35c.	19.10c.
Less ton lots	17.00c.	17.35c.	19.60c.

Calcium Metal

Eastern zone contract prices per lb. of metal, f.o.b. shipping point, freight allowed to destination. Add 5c. for spot sales. Add 0.9c. for Central Zone; 0.49c. for Western Zone.

	Cast	Turnings	Distilled
Ton lots	$1.80	$2.30	$5.00
Less ton lots	2.30	2.80	5.75

Chromium—Copper

Contract price per lb. of alloy, f.o.b. Niagara Falls, freight allowed east of the Mississippi River. 8-11% Cr, 88-90% Cu, 1.00% max. Fe, 0.50% max. Si. Add 2c. for spot sales.

Shot or ingot	45c.

Ferroboron

Contract prices per lb. of alloy, f.o.b. shipping point, freight allowed to destination. Add 5c. for spot sales. 17.50% min. B, 1.50% max. Si, 0.50% max. Al, 0.50% max. C.

	Eastern Zone	Central Zone	Western Zone
Ton lots	$1.20	$1.2075	$1.289
Less ton lots	1.30	1.3075	1.329

Manganese—Boron

Contract prices per lb. of alloy, f.o.b. shipping point, freight charges allowed. Add 5c. for spot sales.

75.00% Mn, 15-20% B, 5% max. Fe, 1.50% max. Si, 3.00% max. C.

	Eastern Zone	Central Zone	Western Zone
Ton lots	$1.89	$1.903	$1.935
Less ton lots	2.01	2.023	2.055

Nickel—Boron

Spot and contract prices per lb. of alloy, f.o.b. shipping point, freight allowed to destination.

15-18% B, 1.00% max. Al, 1.50% max. Si, 0.50% max. C, 3.00% max. Fe, balance Ni.

	Eastern Zone	Central Zone	Western Zone
11,200 lb. or more	$1.90	$1.9125	$1.9445
Ton lots	2.00	2.09125	2.0445
Less ton lots	2.10	2.1125	2.1445

Other Ferroalloys

Ferrotungsten, Standard grade lump or ¼X down, packed, f.o.b. plant at Niagara Falls, New York, Washington, Pa. York, Pa., per lb. contained tungsten, 10,000 lb. or more	$1.90
Ferrovanadium, 35-55%, contract basis, f.o.b. producer's plant, usual freight allowances, per lb. contained Va.	
Open hearth	$2.70
Crucible	$2.80
Primos	$2.90
Cobalt, 97% min., keg packed, contract basis, f.o.b. producer's plant, usual freight allowances, per lb. of cobalt metal	$1.50
Vanadium pentoxide, 88-92% V_2O_5 technical grade, contract basis, any quantity, per lb. contained V_2O_5. Spot sales add 5c. per lb. contained V_2O_5	$1.10
Silcaz No. 3, contract basis, f.o.b. producer's plant with usual freight allowances, per lb. of alloy. (Pending OPA approval)	
Carload lots	25c.
2000 lb. to carload	26c.
Silvaz No. 3, contract basis, f.o.b. producer's plant with freight allowances, per lb. of alloy (Pending OPA approval)	
Carload lots	58c.
2000 lb. to carload	59c.
Grainal, f.o.b. Bridgeville, Pa., freight allowed 50 lb. and over, max. based on rate to St. Louis	
No. 1	87.5c.
No. 6	60c.
No. 79	45c.
Bortram, f.o.b. Niagara Falls	
Ton lots, per lb.	45c.
Less ton lots, per lb.	50c.
Ferrocolumbium, 50-60%, contract basis, f.o.b. plant with freight allowances, per lb. contained Cb.	
2000 lb. lots	$2.25
Under 2000 lb. lots	$2.30
Ferrotitanium, 40-45%, 0.10%C. max. f.o.b. Niagara Falls, N. Y., ton lots, per lb. contained Ti	$1.23
Less ton lots	$1.25
Ferrotitanium, 20-25%, 0.10%C. max., ton lots, per lb. contained titanium	$1.35
Less ton lots	$1.40
High-carbon ferrotitanium, 15%-20%, 6-8% carbon, contract basis, f.o.b. Niagara Falls, N. Y. freight allowed East of Mississippi River, north of Baltimore and St. Louis, per carload	$142.50
Ferrophosphorus, 18% electric or blast furnaces, f.o.b. Anniston, Ala., carlots, with $3 unitage freight equalled with Rockdale, Tenn., per gross ton	58.50
Ferrophosphorus, electrolytic 23-26%, carlots, f.o.b. Monsanto (Sigio), Tenn., $3 unitage freight equalized with Nashville, per gross ton	$75.00
Ferromolybdenum, 55-75%, f.o.b. Langeloth, Washington, Pa., any quantity, per lb. contained Mo.	95c.
Calcium molybdate, 40-45%, f.o.b. Langeloth and Washington, Pa., any quantity, per lb. contained Mo.	80c.
Molybdenum oxide briquets, 48-52% Mo. f.ob. Langeloth, Pa. per lb. contained Mo	80c.
Molybdenum oxide, in cans, f.o.b Langeloth and Washington, Pa. per lb. contained Mo	80c.
Zirconium, 35-40%, contract basis, f.o.b. producer's plant with freight allowances, per lb. of alloy. Add ¼c. for spot sales	
Carload lots	14c.
Zirconium, 12-15%, contract basis, lump f.o.b. plant usual freight allowances, per lb. of alloy	
Carload, bulk	4.6c.
Alsifer (approx. 20% Al, 40% Si and 40% Fe), contract basis, f.o.b. Niagara Falls, carload, bulk	5.75c.
Ton lots	7.25c.
Simanal (approx. 20% Si, 20% Mn, 20% Al), contract basis, f.o.b. Philo, Ohio, with freight not to exceed St. Louis rate allowed, per lb.	
Car lots	8.00c.
Ton lots	8.75c.
Less ton lots	9.25c.